

IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH
LIBRARY



Class No. _____

Book No. _____

UNITED STATES DEPARTMENT OF AGRICULTURE
OFFICE OF EXPERIMENT STATIONS

EXPERIMENT STATION RECORD

VOLUME 62
JANUARY-JUNE, 1930



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1930

U. S. DEPARTMENT OF AGRICULTURE

SECRETARY—A. M. Hyde

DIRECTOR OF SCIENTIFIC WORK—A. F. Woods

OFFICE OF EXPERIMENT STATIONS—W. H. Evans, *Acting Chief*

THE AGRICULTURAL EXPERIMENT STATIONS

- ALABAMA—*Auburn*: M. J. Funchess.¹
 ALASKA—*Sitka*: H. W. Alberts.¹
 ARIZONA—*Tucson*: E. D. Ball.¹
 ARKANSAS—*Fayetteville*: D. T. Gray.¹
 CALIFORNIA—*Berkeley*: C. B. Hutchison.¹
 COLORADO—*Fort Collins*: C. P. Gillette.¹
 CONNECTICUT—
 State Station: *New Haven*; } W. L. Slate.¹
 Storrs Station: *Storrs*; }
 DELAWARE—*Newark*: C. A. McCue.¹
 FLORIDA—*Gainesville*: W. Newell.¹
 GEORGIA—
 Experiment: H. P. Stuckey.¹
 Coastal Plain Station: *Tifton*: S. H. Starr.¹
 GUAM—*Island of Guam*: C. W. Edwards.¹
 HAWAII—
 Federal Station: *Honolulu*: J. M. Westgate.¹
 Pineapple Cannery Station: *Honolulu*: R. N. Chapman.¹
 Sugar Planters' Station: *Honolulu*: H. P. Agee.¹
 IDAHO—*Moscow*: E. J. Iddings.¹
 ILLINOIS—*Urbana*: H. W. Mumford.¹
 INDIANA—*La Fayette*: J. H. Skinner.¹
 IOWA—*Ames*: C. F. Curtiss.¹
 KANSAS—*Manhattan*: L. E. Call.¹
 KENTUCKY—*Lexington*: T. P. Cooper.¹
 LOUISIANA—*Baton Rouge*: O. T. Dowell.¹
 MAINE—*Orono*: W. J. Morse.¹
 MARYLAND—*College Park*: H. J. Patterson.¹
 MASSACHUSETTS—*Amherst*: F. J. Slevens.¹
 MICHIGAN—*East Lansing*: V. B. Gardner.¹
 MINNESOTA—*University Farm, St. Paul*: W. C. Coffey.¹
 MINNESOTA—*A. and M. College*: W. R. Perkins.¹
 MISSOURI—
 College Station: *Columbia*: F. B. Mumford.¹
 Fruit Station: *Mountain Grove*: F. W. Faurot.¹
 Poultry Station: *Mountain Grove*: T. W. Noland.¹
 MONTANA—*Bozeman*: F. B. Linfield.¹
 NEBRASKA—*Lincoln*: W. W. Burr.¹
 NEVADA—*Reno*: S. B. Doten.¹
 NEW HAMPSHIRE—*Durham*: J. O. Kendall.¹
 NEW JERSEY—*New Brunswick*: J. G. Lipman.¹
 NEW MEXICO—*State College*: Fabian Garcia.¹
 NEW YORK—
 State Station: *Geneva*: U. P. Hedrick.¹
 Cornell Station: *Ithaca*: A. R. Mann.¹
 NORTH CAROLINA—*State College Station, Raleigh*:
 R. Y. Winters.¹
 NORTH DAKOTA—*State College Station, Fargo*: P. F. Trowbridge.¹
 OHIO—*Wooster*: C. G. Williams.¹
 OKLAHOMA—*Stillwater*: O. P. Blackwell.¹
 OREGON—*Corvallis*: J. T. Jardine.¹
 PENNSYLVANIA—
 State College: R. L. Watts.¹
 State College: Institute of Animal Nutrition;
 E. B. Forbes.¹
 PORTO RICO—
 Federal Station: *Mayaguez*: T. B. McClelland.¹
 Insular Station: *Rio Piedras*: R. Fernández
 García.¹
 RHODE ISLAND—*Kingston*: B. E. Gilbert.¹
 SOUTH CAROLINA—*Clemson College*: H. W. Barra.¹
 SOUTH DAKOTA—*Brookings*: J. W. Wilson.¹
 TENNESSEE—*Knoxville*: O. A. Moore.¹
 TEXAS—*College Station*: A. B. Conner.¹
 UTAH—*Logan*: P. V. Cardon.¹
 VERMONT—*Burlington*: J. L. Hills.¹
 VIRGINIA—
 Staeburg: A. W. Drinkard, jr.¹
 Truck Station: *Norfolk*: T. C. Johnson.¹
 VIRGIN ISLANDS—*St. Croix*: J. B. Thompson.¹
 WASHINGTON—
 College Station: *Pullman*: E. C. Johnson.¹
 Western Station: *Puyallup*: J. W. Kalkus.¹
 WEST VIRGINIA—*Morgantown*: F. D. Fromme.¹
 WISCONSIN—*Madison*: H. L. Russell.¹
 WYOMING—*Laramie*: J. A. Hill.¹

¹ Director,¹ Superintendent.

EXPERIMENT STATION RECORD

Editor: HOWARD LAWTON KNIGHT

EDITORIAL DEPARTMENTS

Agricultural and Biological Chemistry, Soils and Fertilizers—H. C. WATERMAN.
Meteorology—W. H. BEAL.
Agricultural Botany and Diseases of Plants—W. H. EVANS, W. E. BOYD.
Genetics—H. M. STEECE, J. W. WELLINGTON, G. HAINES.
Field Crops—H. M. STEECE.
Horticulture and Forestry—J. W. WELLINGTON.
Economic Zoology and Entomology—W. A. HOOKER.
Animal Husbandry, Dairying, and Dairy Farming—H. W. MABSTON.
Veterinary Medicine—W. A. HOOKER.
Agricultural Engineering—R. W. TRULLINGER.
Rural Economics and Sociology, Agricultural and Home Economics Education—F. G. HARDEN.
Foods and Human Nutrition—SYBIL L. SMITH.
Textiles and Clothing—H. M. STEECE, SYBIL L. SMITH.
Home Management and Equipment— — — — —.
Indexes—MARTHA C. GUNDLACH.
Bibliographies—CORA L. FELDKAMP.

CONTENTS OF VOLUME 62

EDITORIAL NOTES

	Page
The forty-third convention of the Association of Land-Grant Colleges and Universities.....	1
Research at the 1929 convention of the Association of Land-Grant Colleges and Universities.....	101
An "outsider's" view of the agricultural colleges.....	301
Cooperation in agricultural meteorology.....	401
The retirement of Director May of Porto Rico.....	601
An experimental Institute of Plant Industry in India.....	701

STATION PUBLICATIONS ABSTRACTED

ALABAMA STATION:

Bulletin 229.....	73
Bulletin 230.....	73
Circular 54.....	73
Circular 55.....	73

ALASKA STATIONS:	Page
Report 1928.....	115, 127, 137, 160, 165, 179, 199
ARIZONA STATION:	
Bulletin 129.....	520
Technical Bulletin 28.....	506
ARKANSAS STATION:	
Bulletin 242.....	33
Bulletin 243.....	27
Bulletin 244.....	445
Bulletin 245.....	679
Bulletin 246 (Forty-first Annual Report, 1929).....	810, 814, 816, 817, 828, 834, 844, 851, 866, 867, 869, 872, 874, 879, 885, 899.
CALIFORNIA STATION:	
Bulletin 472.....	80
Bulletin 473.....	280
Bulletin 474.....	46
Bulletin 475.....	179
Bulletin 476.....	384
Bulletin 477.....	332
Bulletin 478.....	371
Bulletin 479.....	527
Bulletin 480.....	484
Bulletin 481.....	458
Bulletin 482.....	477
Bulletin 483.....	489
Bulletin 484.....	722
Circular 316.....	382
Hilgardia, volume 4—	
No. 6, September, 1929.....	140
No. 7, November, 1929.....	441
No. 8, November, 1929.....	471
No. 9, November, 1929.....	504
No. 10, December, 1929.....	505
No. 11, December, 1929.....	722
Pacific Coast Pear Supply and Price Situation, S. W. Shear.....	578
Annual Report, 1929.....	716, 717, 719, 723, 726, 727, 733, 741, 744, 751, 760, 762, 764, 768, 770, 776, 777, 786, 795
COLORADO STATION:	
Bulletin 345.....	60
Bulletin 348.....	37
Bulletin 349.....	880
Bulletin 351.....	52
Bulletin 352.....	55
Bulletin 353.....	281
Bulletin 355.....	283
Press Bulletin 69.....	254
Press Bulletin 70.....	253
CONNECTICUT STATE STATION:	
Bulletin 308.....	418
Bulletin 309.....	795
Bulletin 310.....	731
Bulletin 311.....	831
Fifty-second Report, 1928.....	509

CONNECTICUT STORES STATION :

	Page
Bulletin 157 -----	378
Bulletin 158 -----	376
Bulletin 159 -----	371

DELAWARE STATION :

Bulletin 161 -----	738
Bulletin 162 (Annual Report, 1929) -----	718,
	719, 728, 735, 745, 749, 753, 763, 765, 772, 795
Bulletin 163 -----	468

FLORIDA STATION :

Annual Report, 1928 -----	317
	325, 334, 343, 351, 354, 374, 388, 392, 394, 397, 399

GEORGIA STATION :

Bulletin 154 -----	21
Bulletin 155 -----	85
Bulletin 156 -----	99
Bulletin 157 -----	85
Bulletin 158 -----	35

GEORGIA COASTAL PLAIN STATION :

Bulletin 11 (Ninth Annual Report 1928) -----	728 736 757, 796
--	------------------

HAWAII STATION :

Bulletin 58 -----	231
Bulletin 59 -----	529
Bulletin 60 -----	685

HAWAIIAN PINEAPPLE CANNERS' STATION

Bulletin 1 -----	342
Bulletin 2 -----	342
Bulletin 3 -----	419
Bulletin 4 -----	437
Bulletin 5 -----	489
Bulletin 6 -----	457
Bulletin 8 -----	418
Bulletin 10 -----	445
Bulletin 11 -----	437
Bulletin 12 -----	437

IDAHO STATION :

Bulletin 158 -----	19, 22, 77, 82
--------------------	----------------

ILLINOIS STATION :

Bulletin 337 -----	13
Bulletin 338 -----	364
Bulletin 339 -----	521
Bulletin 340 -----	749
Bulletin 341 -----	839
Circular 346 -----	212
Circular 347 -----	198
Circular 348 -----	263
Circular 349 -----	229
Circular 350 -----	759
Circular 351 -----	890
Circular 352 -----	868
Soil Report 44 -----	118

ILLINOIS STATION—Continued.

	Page
Soil Report 45.....	716
Forty-second Annual Report, 1929.....	314,
323, 327, 328, 335, 346, 352, 361, 363, 364, 365, 367, 369, 371, 374, 379,	
381, 385, 390, 391, 399.	

INDIANA STATION:

Bulletin 332.....	679
Circular 163.....	508
Circular 164.....	22, 30, 38, 99
Circular 165.....	657
Circular 166.....	665
Circular 167.....	656
Circular 168.....	867
Circular 169.....	834
Francisco Experiment Field—	
Results of Soil Fertility Investigations, 1917-1928.....	317
Jennings County Experiment Field—	
Progress Report, 1921-1927.....	317
Progress Report, 1921-1928.....	317
Pinney-Purdue Experiment Field—	
Report of Progress, 1920-1928.....	317
Scottsburg Experiment Field—	
Results of Soil Fertility Investigations, 1906-1928.....	317
Worthington Experiment Field—	
Results of Soil Fertility Investigations, 1913-1928.....	317
Soils and Crops Experiment Farm—	
Report of Progress, 1915-1926.....	317
Report of Progress, 1915-1928.....	317

IOWA STATION:

Bulletin 262.....	32
Bulletin 262 (abridged edition).....	32
Bulletin 263.....	43
Bulletin 264.....	83
Bulletin 265.....	33
Bulletin 265 (abridged edition).....	33
Circular 117.....	358
Circular 118.....	484
Circular 119.....	462
Soil Survey Report 56.....	19
Soil Survey Report 57.....	19
Soil Survey Report 58.....	19
Soil Survey Report 59.....	19

KANSAS STATION:

Bulletin 247.....	670
Bulletin 248.....	634
Circular 148.....	663
Circular 149.....	795
Fort Hays Substation, Beef Cattle Investigations, 1923-29.....	362, 383

KENTUCKY STATION:

Bulletin 290.....	508
Bulletin 291.....	68
Bulletin 292.....	178

KENTUCKY STATION—Continued.

	Page
Bulletin 293.....	355
Bulletin 294.....	368
Bulletin 295.....	360
Forty-first Annual Report, 1928, Part 1.....	203,
204, 210, 218, 227, 233, 245, 253, 254, 255, 262, 266, 278, 293, 299	299

MAINE STATION :

Bulletin 349.....	610, 644, 696
Bulletin 350.....	36
Bulletin 351.....	677
Bulletin 352.....	632
Official Inspections 132.....	160
Official Inspections 133.....	508

MARYLAND STATION :

Bulletin 310.....	243
Bulletin 311.....	334
Bulletin 312.....	340
Bulletin 313.....	340
Bulletin 314.....	339
Bulletin 315.....	341, 387
Bulletin 316.....	870
Bulletin 317.....	830
Bulletin 318.....	838

MASSACHUSETTS STATION :

Bulletin 252.....	47
Bulletin 253.....	257
Bulletin 254.....	440
Bulletin 255.....	663
Meteorological Series Bulletins 487-488, July-August, 1929.....	115
Meteorological Series Bulletins 489-490, September-October, 1929.....	200
Meteorological Series Bulletins 491-492, November-December, 1929.....	610
Meteorological Series Bulletins 493-494, January-February, 1930.....	809

MICHIGAN STATION :

Special Bulletin 141 (revision).....	435
Special Bulletin 192.....	20
Technical Bulletin 100.....	75
Technical Bulletin 101.....	12
Quarterly Bulletin, volume 12, No. 2, November, 1929.....	426,
434, 435, 438, 457, 458, 460, 480	480
Circular 127.....	229
Circular 128.....	668
Circular 129.....	870

MINNESOTA STATION :

Bulletin 255.....	389
Bulletin 256.....	477
Bulletin 257.....	677
Bulletin 258.....	767
Technical Bulletin 59.....	236
Technical Bulletin 60.....	231
Technical Bulletin 61.....	451
Technical Bulletin 62.....	428
Thirty-seventh Annual Report, 1929.....	696

MISSISSIPPI STATION:		Page
Bulletin 267	-----	143
Bulletin 268	-----	161
Bulletin 269	-----	575
Bulletin 270	-----	550
Technical Bulletin 17	-----	506
Circular 84	-----	571
Circular 85	-----	632
Fortieth Annual Report, 1927	22, 31, 38, 53, 56, 60, 63, 66, 69, 99	
Forty-first Annual Report, 1928	-----	111,
	127, 137, 144, 145, 152, 161, 162, 163, 164, 170, 199	
MISSOURI STATION:		
Bulletin 271	-----	78
Bulletin 272 (Annual Report, 1928)	9, 16, 22, 23,	
	29, 31, 39, 46, 50, 54, 60, 64, 67, 70, 72, 73, 77, 82, 86, 94, 95, 97, 99	
Bulletin 273	-----	482
Bulletin 274	-----	767
Bulletin 275	-----	767
Bulletin 276	-----	721
Research Bulletin 118	-----	761
Research Bulletin 122	-----	461
MONTANA STATION:		
Bulletin 222	-----	226
Bulletin 223	-----	755
Thirty-fifth Annual Report, 1928	-----	209,
	210, 219, 227, 233, 234, 242, 253, 257, 260, 299	
NEBRASKA STATION:		
Bulletin 237	-----	741
Research Bulletin 44	-----	748
Research Bulletin 45	-----	732
NEVADA STATION:		
Bulletin 117	-----	575
Annual Report, 1928	18, 55, 62, 72, 76, 99	
NEW HAMPSHIRE STATION:		
Bulletin 245	-----	360
Bulletin 246	-----	334
Circular 30	-----	472
NEW JERSEY STATIONS:		
Bulletin 485	-----	524
Bulletin 487	-----	285
Bulletin 488	-----	60
Bulletin 489	-----	572
Bulletin 490	-----	721
Bulletin 491	-----	756
Circular 217	-----	45
Circular 218	-----	523
Circular 219	-----	523
Circulars 220-224	-----	840
Hints to Poultrymen—		
Volume 17—		
No. 10, July, 1929	-----	80
No. 11, August, 1929	-----	68
No. 12, September, 1929	-----	69

NEW JERSEY STATIONS—Continued.

Hints to Poultrymen—Continued.

Volume 18—

No. 1, October, 1929.....	678
No. 2, November, 1929.....	663
No. 3, December, 1929.....	658

NEW MEXICO STATION:

Bulletin 176.....	32
Bulletin 177.....	257
Bulletin 178.....	760
Bulletin 179.....	761

NEW YORK CORNELL STATION:

Bulletin 478.....	80
Bulletin 479.....	278
Bulletin 480.....	42
Bulletin 481.....	57
Bulletin 482.....	82
Bulletin 483.....	481
Bulletin 484.....	83
Bulletin 485.....	84
Bulletin 486.....	86
Bulletin 487.....	184
Bulletin 488.....	25
Bulletin 489.....	452
Bulletin 491.....	522
Bulletin 492.....	497
Bulletin 493.....	683
Bulletin 494.....	680
Bulletin 495.....	783
Bulletin 496.....	780
Bulletin 497.....	739
Bulletin 498.....	740
Bulletin 499.....	840
Memoir 125.....	724
Memoir 126.....	759
Mimeographed Bulletin 1.....	684
Forty-second Annual Report, 1929.....	710, 719, 720, 726, 731, 732, 736, 746, 760, 765, 766, 780, 781, 788, 796

NEW YORK STATE STATION:

Bulletin 570.....	10
Bulletin 571.....	73
Bulletin 572.....	68
Bulletin 573.....	21
Bulletin 574.....	740
Bulletin 575.....	741
Bulletin 576.....	748
Bulletin 577.....	738
Bulletin 578.....	738
Bulletin 579.....	740
Technical Bulletin 150.....	9
Technical Bulletin 151.....	10
Technical Bulletin 152.....	9
Technical Bulletin 153.....	392

NEW YORK STATE STATION—Continued.

	Page
Technical Bulletin 154.....	392
Technical Bulletin 155.....	373
Technical Bulletin 156.....	373
Technical Bulletin 157.....	769
Technical Bulletin 158.....	768
Circular 114.....	731
Forty-eighth Annual Report, 1929.....	407,
	416, 430, 431, 439, 449, 463, 464, 469, 497

NORTH CAROLINA STATION:

Bulletin 268.....	348
Agronomy Information Circular 30.....	37
Agronomy Information Circular 32.....	487
Agronomy Information Circular 33.....	487
Agronomy Information Circulars 34-41.....	615
Agronomy Information Circular 42.....	629
Agronomy Information Circular 43.....	629
Agronomy Information Circular 44.....	629
Agronomy Information Circular 46.....	732

NORTH DAKOTA STATION:

Bulletin 228.....	129, 138, 162, 199
Bulletin 229.....	129, 138, 162, 199
Bulletin 230.....	367
Bulletin 231.....	349
Bulletin 232.....	783
Circular 38.....	181
Circular 39.....	760

OHIO STATION:

Bulletin 438.....	182
Bulletin 439.....	143
Bulletin 440.....	183
Bulletin 441.....	136
Bulletin 442.....	286
Bulletin 443.....	485
Bulletin 444.....	527
Bulletin 445.....	610
Bimonthly Bulletin 141.....	334, 343, 351, 369, 371, 384, 386
Bimonthly Bulletin 142.....	634, 638, 639, 644, 645, 660, 677, 686, 696
Special Circular 15.....	80
Special Circular 16.....	63
Special Circular 17.....	65
Special Circular 18.....	45
Special Circular 19.....	90
Special Circular 20.....	90
Special Circular 21.....	62
Special Circular 22.....	90
Special Circular 23.....	35, 40
Special Circular 24.....	22
Special Circular 25.....	37
Special Circular 26.....	763
Forest News, Nos. 1-7, 1928-1929.....	743
Forestry Publication 1.....	844

OKLAHOMA STATION:

	Page
Bulletin 186.....	485
Bulletin 188.....	211
Bulletin 189.....	211
Bulletin 190.....	412
Bulletin 192.....	217
Bulletin 193.....	210
Circular 75.....	288
Circular 76.....	784

[OKLAHOMA] PANHANDLE STATION:

Panhandle Bulletin 9.....	69
Panhandle Bulletin 10.....	211
Panhandle Bulletin 11.....	461
Panhandle Bulletin 12.....	633, 645, 656
Panhandle Bulletin 13.....	766
Panhandle Bulletin 14.....	812, 829, 870, 899

OREGON STATION:

Bulletin 253.....	77
Bulletin 254.....	44
Bulletin 255.....	79
Bulletin 256.....	406
Bulletin 257.....	483
Bulletin 258.....	873
Bulletin 259.....	839
Circular 94.....	575
Circular 95.....	524

PENNSYLVANIA STATION:

Bulletin 233.....	258
Bulletin 239.....	440
Bulletin 240.....	37
Bulletin 241.....	81
Bulletin 242.....	86
Bulletin 243 (Forty-second Annual Report, 1929).....	311, 313, 314, 317, 318, 320, 322, 334, 338, 342, 347, 352, 365, 367, 370, 372, 380, 382, 397, 399
Bulletin 244.....	433

PORTO RICO STATION:

Report, 1928.....	719, 720, 731, 737, 747, 751, 768, 771, 796
-------------------	---

PORTO RICO DEPARTMENT OF AGRICULTURE AND LABOR STATION:

Annual Report, 1927.....	32, 42, 99
Annual Report, 1928.....	138, 146, 153, 165, 199

RHODE ISLAND STATION:

Bulletin 219.....	83
Bulletin 220.....	485
Bulletin 221.....	598
Bulletin 222.....	564
Annual Fertilizer Circular, 1929.....	121

SOUTH CAROLINA STATION:

Bulletin 260.....	289
Bulletin 261.....	221
Bulletin 262.....	507
Circular 37.....	33

SOUTH CAROLINA STATION—Continued.

	Page
Circular 38.....	855
Circular 39.....	859
Circular 40.....	830
Forty-second Annual Report, 1929.....	614,
	615, 625, 629, 635, 641, 650, 659, 660, 661, 664, 665, 676, 696

SOUTH DAKOTA STATION:

Bulletin 239.....	272
Bulletin 240.....	231
Bulletin 241.....	99
Bulletin 242.....	68
Bulletin 243.....	85
Bulletin 244.....	779

TENNESSEE STATION:

Bulletin 140.....	543
Bulletin 141.....	508
Circular 25.....	522
Circular 26.....	769
Circular 27.....	738
Circular 28.....	758

TEXAS STATION:

Bulletin 400.....	718
Bulletin 401.....	246
Bulletin 402.....	252
Bulletin 403.....	213
Forty-first Annual Report, 1928.....	614, 625,
	626, 631, 636, 641, 642, 651, 656, 658, 660, 661, 663, 665, 666, 692, 696

UTAH STATION:

Bulletin 214.....	886
Circular 80.....	255
Circular 81.....	549
Circular 82.....	549
Circular 83.....	838
Circular 84.....	838

VERMONT STATION:

Bulletin 294.....	298
Bulletin 295.....	252
Bulletin 296.....	319
Bulletin 297.....	349
Bulletin 298.....	232
Bulletin 299.....	259
Bulletin 300.....	258
Bulletin 301.....	213
Bulletin 302 (Forty-second Annual Report, 1929).....	339, 343, 347, 370, 399
Bulletin 303.....	234
Bulletin 304.....	232
Bulletin 305.....	760
Bulletin 306.....	733
Bulletin 307.....	782

VIRGIN ISLANDS STATION:

Report, 1928.....	209, 219, 227, 256, 299
-------------------	-------------------------

VIRGINIA STATION :		Page
Bulletin 267.....		185
Bulletin 268.....		573
Technical Bulletin 37.....		784
Technical Bulletin 38.....		164
Technical Bulletin 39.....		756
Technical Bulletin 40.....		757
VIRGINIA TRUCK STATION :		
Bulletin 67.....		883
Bulletin 68.....		859
Bulletin 69.....		849
WASHINGTON COLLEGE STATION :		
Bulletin 233.....		87
Bulletin 234.....		598
Bulletin 235.....		37
Bulletin 236.....		536
Popular Bulletin 145.....		271
Popular Bulletin 146.....		766
WESTERN WASHINGTON STATION :		
Bulletin 13-W.....		59
Bulletin 14-W (Annual Report, 1929).....	508, 518, 523, 532, 540, 557, 599	
Bulletin 15-W.....		766
WEST VIRGINIA STATION :		
Bulletin 222.....		228
Bulletin 223.....		663
Bulletin 224.....		678
Bulletin 225.....		658
Bulletin 226.....		887
Circular 51.....		35
WISCONSIN STATION :		
Bulletin 409.....		367
Research Bulletin 91.....		15
Research Bulletin 92.....		58
Research Bulletin 93.....		56
Research Bulletin 94.....		43
Research Bulletin 95.....		350
Research Bulletin 96.....		784
WYOMING STATION :		
Bulletin 167.....		546
Bulletin 168.....		506
Bulletin 169.....		868
Circular 22.....		532

**UNITED STATES DEPARTMENT OF AGRICULTURE
PUBLICATIONS EXTRACTED**

Bulletin 1390, Supplement 1, Chemistry and Analysis of the Permitted Coal-Tar Food Dyes Ponceau SX, Sunset Yellow FCF, and Brilliant Blue FCF, O. L. Evenson and H. T. Herrick.....	808
Bulletin 1495, Cover Type and Fire Control in the National Forests of Northern California, S. B. Shaw and E. I. Kotok.....	232
Bulletin 1497, Forest Planting in the Lake States, J. Kittredge, jr.....	45

	Page
Bulletin 1499, Timber Growing and Cutting Practice in the Lodgepole Pine Region, M. W. Thompson.....	45
Technical Bulletin 86, Imported Insect Enemies of the Gipsy Moth and the Brown-Tail Moth, A. F. Burgess and S. S. Crossman.....	350
Technical Bulletin 96, Yields of Barley in the United States and Canada, 1922-1926, H. V. Harlan, L. H. Newman, and M. L. Martini.....	330
Technical Bulletin 101, Agricultural Survey of Europe: Switzerland, A. Hobson.....	283
Technical Bulletin 109, A Study of the Oil Burner as Applied to Domestic Heating, A. H. Senner.....	97
Technical Bulletin 112, Biology of the Cotton Boll Weevil at Florence, S. C., F. A. Fenton and E. W. Dunnam.....	358
Technical Bulletin 113, Arrow Grass (<i>Triglochin maritima</i>) as a Stock-Poisoning Plant, C. D. Marsh, A. B. Clawson, and G. C. Roe.....	74
Technical Bulletin 114, Sleepy Grass (<i>Stipa vaseyi</i>) as a Stock-Poisoning Plant, C. D. Marsh and A. B. Clawson.....	74
Technical Bulletin 118, Studies in Time and Rate of Irrigating Potatoes in Colorado, W. C. Edmundson.....	224
Technical Bulletin 119, Influence of Freezing of Seed Potatoes on Viability and Yield, R. C. Wright, W. M. Peacock, and P. M. Lombard.....	26
Technical Bulletin 121, Methods of Harvesting Grain Sorghums, J. H. Martin, L. A. Reynoldson, B. E. Rothgeb, and W. M. Hurst.....	132
Technical Bulletin 122, Development of Runners and Runner Plants in the Strawberry, G. M. Darrow.....	44
Technical Bulletin 123, Bud Selection in the Washington Navel Orange: Progeny Tests of Limb Variations, A. D. Shamel, C. S. Pomeroy, and R. E. Caryl.....	436
Technical Bulletin 126, Agricultural Survey of Europe: The Danube Basin—Part 2, Rumania, Bulgaria, and Yugoslavia, L. G. Michael.....	283
Technical Bulletin 127, An Economic Study of Livestock Possibilities in the Southeastern Coastal Plain, R. D. Jennings and M. A. Crosby.....	179
Technical Bulletin 128, Alteration of Muscovite and Biotite in the Soil, I. A. Denison, W. H. Fry, and P. L. Gile.....	120
Technical Bulletin 129, Flow of Water in Drainage Channels, C. E. Ramser.....	671
Technical Bulletin 130, The Chestnut Curculios, F. E. Brooks and R. T. Cotton.....	250
Technical Bulletin 131, Spacing and Date-of-Seeding Experiments with Grain Sorghums, J. H. Martin, J. B. Sieglinger, A. F. Swanson, D. R. Burnham, H. J. Clemmer, E. H. Coles, F. E. Keating, and W. M. Osborn.....	331
Technical Bulletin 132, Decay of Slash of Northern White Pine in Southern New England, P. Spaulding.....	239
Technical Bulletin 133, Flax Cropping in Mixture with Wheat, Oats, and Barley, A. C. Arny, T. E. Stoa, C. McKee, and A. C. Dillman.....	330
Technical Bulletin 134, Red-Squill Powders as Raticides, J. C. Munch, J. Silver, and E. E. Horn.....	446
Technical Bulletin 135, The Corn Borer in Central Europe: A Review of Investigations from 1924 to 1927, K. W. Babcock and A. M. Vance.....	453
Technical Bulletin 136, Breeding Hard Red Winter Wheats for Winter Hardiness and High Yield, K. S. Quisenberry and J. A. Clark.....	134
Technical Bulletin 137, The Pandora Moth, a Periodic Pest of Western Pine Forests, J. E. Patterson.....	356

	Page
Technical Bulletin 138, Studies on the Fall Army Worm in the Gulf Coast District of Texas, R. A. Vickery.....	357
Technical Bulletin 139, Properties of Western Hemlock and Their Relation to Uses of the Wood, R. P. A. Johnson and W. H. Gibbons.....	641
Technical Bulletin 140, Investigations on the Handling of Bartlett Pears from Pacific Coast Districts, J. R. Magness, H. C. Diehl, and F. W. Allen.....	230
Technical Bulletin 141, The Spontaneous Combustion of Hay, C. A. Browne.....	176
Technical Bulletin 142, Yields of Second-Growth Spruce and Fir in the Northeast, W. H. Meyer.....	531
Technical Bulletin 144, Irrigated Crop Rotations in Southern Montana, S. H. Hastings and D. Hansen.....	128
Technical Bulletin 145, Life History and Habits of Grasshopper Mice, Genus <i>Onychomys</i> , V. Bailey and C. C. Sperry.....	446
Technical Bulletin 147, The Habits and Economic Importance of Alligators, R. Kellogg.....	750
Technical Bulletin 148, The Frozen-Pack Method of Preserving Berries in the Pacific Northwest, H. C. Diehl, J. R. Magness, C. R. Gross, and V. B. Bonney.....	787
Technical Bulletin 149, Fungous Diseases of the Honeybee, C. E. Burnside.....	759
Technical Bulletin 150, The Flow of Water in Riveted Steel and Analogous Pipes, F. C. Scobey.....	778
Technical Bulletin 151, Vegetative Propagation from the Standpoint of Plant Anatomy, J. H. Priestley and C. F. Swingle.....	509
Technical Bulletin 152, Life History of the Oriental Peach Moth in Georgia, O. I. Snapp and H. S. Swingle.....	357
Technical Bulletin 153, Effect of Milk-Plant Arrangement and Methods of Operation on Labor Requirements, C. E. Clement, P. E. Le Fevre, J. B. Bain, and F. M. Grant.....	782
Technical Bulletin 154, A Method for Determining the Color of Agricultural Products, D. Nickerson.....	508
Technical Bulletin 155, Quaking Aspen: A Study in Applied Forest Pathology, E. P. Meinecke.....	743
Technical Bulletin 156, Investigations in Weed Control by Zinc Sulphate and Other Chemicals at the Savenac Forest Nursery, W. G. Wahlenberg.....	743
Technical Bulletin 157, The Western Grass-Stem Sawfly, a Pest of Small Grains, C. N. Ainslie.....	548
Technical Bulletin 159, Keeping Quality of Butter Made from Cream of Various Acidities, W. White, C. S. Trimble, and H. L. Wilson.....	258
Technical Bulletin 160, Agricultural Survey of Europe: Hungary, L. G. Michael.....	889
Technical Bulletin 161, Life History, Habits, and Control of the Mormon Cricket, F. T. Cowan.....	654
Farmers' Bulletin 1580, Cigar-Tobacco Production in Pennsylvania, O. Olson.....	134
Farmers' Bulletin 1582, Protection of Log Cabins, Rustic Work, and Unseasoned Wood from Injurious Insects, R. A. St. George.....	55
Farmers' Bulletin 1583, Spring-Sown Red Oats, T. R. Stanton and F. A. Coffman.....	35
Farmers' Bulletin 1585, Varieties of Hard Red Winter Wheat, J. A. Clark and K. S. Quisenberry.....	37
Farmers' Bulletin 1591, Transplanting Trees and Shrubs, F. L. Mulford.....	144

	Page
Farmers' Bulletin 1598, Trembles, C. D. Marsh.....	75
Farmers' Bulletin 1597, The Production of Johnson Grass for Hay and Pasturage, H. N. Vinal and M. A. Crosby.....	35
Farmers' Bulletin 1598, Mountain Beavers in the Pacific Northwest: Their Habits, Economic Status, and Control, T. H. Scheffler.....	52
Farmers' Bulletin 1599, Scab of Wheat and Barley and Its Control, J. G. Dickson and E. B. Mains.....	236
Farmers' Bulletin 1601, Collection and Preservation of Insects for Use in the Study of Agriculture, M. C. Mansuy.....	54
Farmers' Bulletin 1602, Reed Canary Grass, H. A. Schoth.....	36
Farmers' Bulletin 1603, Planting and Care of Shelter Belts on the North- ern Great Plains, R. Wilson.....	144
Farmers' Bulletin 1604, Dairy-Herd-Improvement Associations, and Stories the Records Tell, J. C. McDowell.....	257
Farmers' Bulletin 1605, Soybean Hay and Seed Production, W. J. Morse....	226
Farmers' Bulletin 1606, Farm Drainage, L. A. Jones.....	271
Farmers' Bulletin 1607, The Nematode Disease of Wheat and Rye, R. W. Leukel.....	349
Farmers' Bulletin 1608, The Operation and Care of the Combined Harvester-Thresher, W. M. Hurst.....	388
Farmers' Bulletin 1609, Lettuce Growing, W. R. Beattie.....	340
Farmers' Bulletin 1610, Dairy Farming for Beginners, J. B. Shepherd....	369
Farmers' Bulletin 1611, Oats in the Western Half of the United States, T. R. Stanton and F. A. Coffman.....	632
Farmers' Bulletin 1612, Propagation of Aquatic Game Birds, W. L. McAtee.....	646
Farmers' Bulletin 1613, Propagation of Upland Game Birds, W. L. McAtee.....	646
Farmers' Bulletin 1614, Business Records for Poultry Keepers, E. R. Johnson and A. R. Lee.....	678
Farmers' Bulletin 1615, Hay Stackers and Their Use, L. A. Reynoldson....	674
Farmers' Bulletin 1616, Game Laws for the Season 1929-30: A Summary of Federal, State, and Provincial Statutes, F. L. Earnshaw and F. G. Grimes.....	240
Farmers' Bulletin 1617, Soybean Utilization, W. J. Morse.....	733
Farmers' Bulletin 1618, Fur Laws for the Season 1929-30, F. L. Earnshaw and F. G. Grimes.....	351
Farmers' Bulletin 1619, Sorgo for Sirup Production: Culture, Harvesting, and Handling, H. B. Cowgill.....	738
Statistical Bulletin 27, Car-Lot Shipments of Fruits and Vegetables from Stations in the United States for the Calendar Years 1926 and 1927, compiled by E. Lawrence and L. Norgren.....	887
Circular 63, Conservation of Wastes from the Small-Scale Slaughter of Meat Animals, G. P. Walton and R. F. Gardiner.....	121
Circular 66, Cacti, D. Griffiths and C. H. Thompson.....	231
Circular 69, Work of the Newlands Field Station, Nevada, 1924-1927, E. W. Knight.....	20, 32, 40, 64, 99
Circular 78, Condition of Farmers in a White-Farmer Area of the Cotton Piedmont, 1924-1926, H. A. Turner and L. D. Howell.....	280
Circular 79, The Application of Statistical Methods to Seed Testing, G. N. Collins.....	227
Circular 80, Organization and Management Problems of Cooperative Oil Associations in Minnesota, R. K. Froker and H. B. Price.....	579

	Page
Circular 81, Removing Smut from Pacific Northwest Wheat by Washing, E. N. Bates, G. P. Bodnar, and R. L. Baldwin.....	134
Circular 82, Improved Reindeer Handling, L. J. Palmer.....	364
Circular 83, The Handling of California Table Grapes, C. W. Mann.....	528
Circular 84, Vitamins in Food Materials, S. L. Smith.....	293
Circular 85, Studies of Cotton Root Rot at Greenville, Tex., H. C. McNamara and D. R. Hooton.....	443
Circular 86, A Business Analysis of the Producers Live Stock Commission Association of National Stock Yards, Ill., K. B. Gardner.....	680
Circular 87, Problems in Cooperation and Experiences of Farmers in Marketing Potatoes, T. B. Manny.....	285
Circular 88, Variety Tests of Sugarcanes in Louisiana during the Crop Year 1927-28, G. Arceneaux and F. D. Stevens.....	333
Circular 89, Nutritive Value and Cost of Food Served to College Students, E. Hawley.....	187
Circular 90, Marketing Fresh Fruit in Europe, E. Smith.....	182
Circular 91, Market Supplies and Prices of Apples, J. W. Park.....	578
Circular 92, Forest Nursery and Planting Practice in the California Pine Region, S. B. Shaw.....	639
Circular 93, The Blakemore Strawberry, G. M. Darrow and G. F. Waldo.....	140
Circular 94, Farmers' Cooperative Associations in the United States, 1929, C. L. Christensen.....	85
Circular 95, Subsoil an Important Factor in the Growth of Apple Trees in the Ozarks, A. T. Sweet.....	716
Circular 96, Game Birds Suitable for Naturalizing in the United States, W. L. McAtee.....	447
Circular 97, Rate of Deterioration of Sugar Content of Some P. O. J. Sugarcane Varieties in Louisiana, G. B. Sartoris.....	333
Circular 98, The Wonderful Variety of Pomegranate: Composition, Commercial Maturity, and By-products, E. M. Chace, C. G. Church, and H. D. Poore.....	842
Circular 99, Equipment for City Milk Plants, C. E. Clement and F. M. Grant.....	770
Circular 100, Business Analysis of the Tobacco Growers' Cooperative Association, J. J. Scanlan and J. M. Tinley.....	285
Circular 101, The Farm Real Estate Situation, 1928-29, E. H. Wiecking.....	573
Miscellaneous Circular 46 (rev.), A Bibliography of the European Corn Borer (<i>Pyrausta nubilalis</i> Hbn.), J. S. Wade.....	248
Miscellaneous Circular 50, The Angora Goat and Mohair Industry, G. T. Willingmyre et al.....	460
Leaflet 31, Termites in Buildings, T. E. Snyder.....	56
Leaflet 43, Wild Garlic and Its Control, M. W. Talbot.....	38
Leaflet 44, Fires on Farms, H. E. Roethe.....	82
Leaflet 45, Pork in Preferred Ways, L. M. Alexander and F. W. Yeatman.....	90
Leaflet 46, Farm Grain Storage, E. G. Boerner, M. C. Betts, and T. A. H. Miller.....	81
Leaflet 47, Hygiene in Fox Farming, K. B. Hanson.....	351
Leaflet 48, Reindeer Recipes, L. Stanley and F. W. Yeatman.....	287
Leaflet 49, Ice Creams Frozen without Stirring, L. Stanley and J. A. Cline.....	238
Leaflet 50, How to Make a Cat Trap, J. Silver and F. N. Jarvis.....	447
Leaflet 51, Improving Cattle in Areas Freed of Ticks, J. R. Mohler.....	254
Leaflet 52, Suits for the Small Boy, C. L. Scott.....	298

	Page
Leaflet 53, Cotton-Louse Control, B. R. Coad, J. W. Folsom, and R. C. Gaines.....	56
Leaflet 54, Play Suits for Winter, B. M. Viemont.....	598
Leaflet 55, Small Trees Wasteful to Cut for Saw Timber, W. W. Ashe.....	844
Miscellaneous Publication 50, Volume, Yield, and Stand Tables for Second-Growth Southern Pines.....	843
Miscellaneous Publication 51, National Wild-Life Reservations.....	52
Miscellaneous Publication 52, How to Find Economic Facts and Apply Them as a Basis for Extension Programs in Home Economics, Dairying, and Forestry, F. E. Ward.....	90
Miscellaneous Publication 53, Disinfecting Seed Potatoes, F. Weiss.....	349
Miscellaneous Publication 54, The Livestock Review for 1923, H. M. Conway.....	85
Miscellaneous Publication 55, Pocket Guide to Alaska Trees, R. F. Taylor.....	743
Miscellaneous Publication 56, Low-Cutting Devices for Harvesting Corn, F. Irons and W. J. Parvis.....	78
Miscellaneous Publication 57, Directory of Officials and Organizations Concerned with the Protection of Birds and Game: 1929, compiled by T. Denmead and F. G. Grimes.....	52
Miscellaneous Publication 58, Manual for Bird Banders, F. C. Lincoln and S. P. Baldwin.....	447
Miscellaneous Publication 59, Reliability of the Tuberculin Test, J. R. Mohler.....	377
Miscellaneous Publication 60, List of Available Publications of the United States Department of Agriculture, June 1, 1929, compiled by J. O. Riley.....	497
Miscellaneous Publication 61, Forest Plantations at Biltmore, North Carolina, F. W. Haasis.....	742
Miscellaneous Publication 62, Bibliography on the Relation of Clothing to Health, R. O'Brien, E. C. Peterson, and R. K. Worner.....	695
Miscellaneous Publication 63, List of Technical Workers in the Department of Agriculture, and Outline of Department Functions, 1929.....	290
Miscellaneous Publication 64, Directory of Field Activities of the Bureau of Plant Industry.....	599
Miscellaneous Publication 65, List of Bulletins of the Agricultural Experiment Stations for the Calendar Years 1927 and 1928, C. E. Pennington.....	795
Miscellaneous Publication 66, Economic Benefits of Eradicating Tuberculosis from Livestock, J. R. Mohler, A. E. Wight, and L. B. Ernest.....	773
Inventory 89, Plant Material Introduced by the Office of Foreign Plant Introduction, Bureau of Plant Industry, October 1 to December 31, 1926.....	213
Inventories 90-91, Plant Material Introduced by the Office of Foreign Plant Introduction, Bureau of Plant Industry, [Jan. 1 to June 30, 1927].	321
Crops and Markets:	
Volume 6—	
No. 9, September, 1929.....	85
No. 10, October, 1929.....	286
No. 11, November, 1929.....	388
No. 12, December, 1929.....	681
Volume 7—	
No. 1, January, 1930.....	681
No. 2, February, 1930.....	887
EXTENSION SERVICE:	
Cooperative Extension Work, 1927, C. B. Smith.....	287

FOOD, DRUG, AND INSECTICIDE ADMINISTRATION:

Digest 2, Fruits and Fruit Products, compiled by M. T. Read.....	Page 312
--	-------------

LIBRARY:

Bibliographical Contribution No. 19, Cattle, Sheep, and Goat Production in the Range Country, compiled by E. B. Hawks and E. W. McComas.....	160
--	-----

BUREAU OF AGRICULTURAL ECONOMICS:

Agricultural Economics Bibliography—

No. 28, The Strawberry Industry in the United States: A Selected List of References on the Economic Aspects of the Industry, compiled by E. M. Colvin.....	179
No. 29, Valuation of Real Estate, with Special Reference to Farm Real Estate, compiled by E. L. Day.....	782
Foreign Section Report 38, United States Agricultural Trade with the Philippines.....	388
Foreign Section Report 39, Imports of Principal Agricultural Products, by Countries, 1925-1928.....	389
Foreign Section Report 40, The Competitive Position of the Dairy Industry of Canada, P. F. Brookens.....	359
Foreign Section Report 41, Foreign Trade of the United States, Annual, 1855-1929: Poultry and Eggs, C. G. Gries.....	338
Foreign Section Report 42, Foreign Trade of the United States, Annual, 1790-1929: Dairy Cattle and Dairy Products, C. G. Gries.....	388
Foreign Section Report 43, The Prune Industry in Yugoslavia, M. J. Newhouse.....	576
Foreign Section Report 44, Foreign Trade of the United States, Annual, 1790-1929: Hogs, Pork, and Pork Products, C. G. Gries.....	578
Foreign Section Report 45, Foreign Trade of the United States, Annual, 1790-1929: Cattle, Beef, and Beef Products, C. G. Gries.....	570
Foreign Section Report 46, Foreign Trade of the United States, Annual, 1790-1929: Wheat and Wheat Products and Rye and Rye Products, C. G. Gries.....	889
Facts about Cotton, 1930 Outlook.....	887
Potato Outlook Charts, with Explanations.....	578
Research in Progress in the Bureau of Agricultural Economics, June 30, 1929.....	82
The Disparity between Wheat Prices in Canada and in the United States and the Grain Storage Situation.....	577
Wheat Outlook Charts, with Explanations.....	387

BUREAU OF BIOLOGICAL SURVEY:

North American Fauna 52, Revision of the American Chipmunks (Genera Tamias and Eutamias), A. H. Howell.....	646
---	-----

BUREAU OF CHEMISTRY:

Digest 1, Spices, compiled by M. T. Read.....	312
---	-----

BUREAU OF CHEMISTRY AND SOILS:

Review of United States Patents Relating to Pest Control, vol. 2—

No. 1, January, 1929.....	754
No. 2, February, 1929.....	754
No. 3, March, 1929.....	754
No. 4, April, 1929.....	754
No. 5, May, 1929.....	754
No. 6, June, 1929.....	754

BUREAU OF CHEMISTRY AND SOILS—Continued.

Review of United States Patents Relating to Pest Control, vol. 2—Con.	Page
No. 7, July, 1929.....	754
No. 8, August, 1929.....	754
No. 9, September, 1929.....	754
No. 10, October, 1929.....	754
No. 11, November, 1929.....	754
No. 12, December, 1929.....	754
[Soil Survey Reports], Series 1923—	
No. [44], Soil Survey of Webster County, Nebraska, L. A. Wolfanger and R. D. Wood.....	115
No. 45, Soil Survey of Columbia County, New York, H. G. Lewis and D. F. Kinsman.....	115
No. 46, Soil Survey of Herkimer County Area, New York, H. G. Lewis et al.....	115
No. 47, Soil Survey of Salem Area, New Jersey, R. T. A. Burke et al.....	317
[Soil Survey Reports], Series 1924—	
No. [23], Soil Survey of Lac Qui Parle County, Minnesota, J. A. Elwell et al.....	413
No. 24, Soil Survey of King City Area, California, E. J. Carpenter et al.....	116
No. 25, Soil Survey of Linn County, Oregon, A. E. Kocher et al.....	116
No. 26, Soil Survey of Middlesex County, Massachusetts, W. J. Latimer and M. O. Lanphear.....	209
No. 27, Soil Survey of Roscommon County, Michigan, J. O. Veatch et al.....	116
No. 28, Soil Survey of Alpena County, Michigan, R. Wildermuth et al.....	116
No. 29, Soil Survey of Cass County, North Dakota, E. W. Knobel et al.....	413
[Soil Survey Reports], Series 1925—	
No. 4, Soil Survey of the Chico Area, California, E. B. Watson et al.....	18
No. 5, Soil Survey of Howard County, Iowa, C. L. Orrben and A. L. Gray.....	18
No. 6, Soil Survey of the Soda Springs-Bancroft Area, Idaho, F. O. Youngs et al.....	18
No. 7, Soil Survey of Bradley County, Arkansas, E. B. Deeter et al.....	117
No. 8, Soil Survey of Nevada County, Arkansas, W. I. Watkins et al.....	117
No. 9, Soil Survey of Northampton County, North Carolina, W. D. Lee and S. F. Davidson.....	117
No. 10, Soil Survey of Wilson County, North Carolina, R. C. Jurney and W. A. Davis.....	713
No. 11, Soil Survey of the Salinas Area, California, E. J. Carpenter and S. W. Cosby.....	713
No. 12, Soil Survey of Warren County, Iowa, A. M. O'Neal and R. E. Devereux.....	713
No. 13, Soil Survey of Hidalgo County, Texas, H. W. Hawker et al.....	713
No. 15, Soil Survey of Monroe County, West Virginia, J. A. Kerr.....	713

BUREAU OF CHEMISTRY AND SOILS—Continued.

[Soil Survey Reports], Series 1925—Continued.

No. 16, Soil Survey of Calumet County, Wisconsin, W. J. Geib et al.....	713
No. 17, Soil Survey of Nuckolls County, Nebraska, L. A. Wolfanger et al.....	713
No. 18, Soil Survey of Hyde County, South Dakota, J. A. Machlis and B. H. Williams.....	713

[Soil Survey Reports], Series 1926—

No. 1, Soil Survey of Quitman County, Georgia, R. E. Devereux and E. D. Fowler.....	117
No. 2, Soil Survey of Moody County, South Dakota, W. I. Watkins and G. A. Larson.....	715
No. 3, Soil Survey of Willacy County, Texas, H. W. Hawker and C. S. Simmons.....	715
No. 4, Soil Survey of the Oroville Area, California, E. J. Carpenter et al.....	715
No. 5, Soil Survey of Carroll County, Iowa, A. M. O'Neal and R. E. Devereux.....	715
No. 6, Soil Survey of Nash County, North Carolina, W. D. Lee and S. R. Bacon.....	715
No. 7, Soil Survey of Rockingham County, North Carolina, R. C. Journey and W. A. Davis.....	715

[Soil Survey Report], Series 1927—

No. 1, Soil Survey of Chickasaw County, Iowa, C. L. Orrben and F. R. Lesh.....	716
--	-----

BUREAU OF ENTOMOLOGY:

List of Entomological Publications of Personnel of Cereal and Forage Insect Investigations, U. S. Bureau of Entomology, 1904-1928, inclusive, compiled by J. S. Wade.....	450
---	-----

FOREST SERVICE:

Progress Report of the Forest Taxation Inquiry.—Digest of State Forest Tax Laws, F. R. Fairchild.....	342
Annual Report and Program of the Southern Forest Experiment Station, 1928.....	843

BUREAU OF HOME ECONOMICS:

Home Economics Bibliography 3 (revised), Selected List of Government Publications on Textiles and Clothing, compiled by R. Van Deman.....	795
---	-----

BUREAU OF PUBLIC ROADS:

Public Roads, volume 10—	
No. 7, September, 1929.....	78
No. 8, October, 1929.....	270
No. 9, November, 1929.....	475
No. 10, December, 1929.....	567
No. 11, January, 1930.....	779
No. 12, February, 1930.....	882

WEATHER BUREAU:

Monthly Weather Review, volume 57—

No. 5, May, 1929.....	15
No. 6, June, 1929.....	15
No. 7, July, 1929.....	208

WEATHER BUREAU—Continued.

Monthly Weather Review, volume 57—Continued.		Page
No. 8, August, 1929	-----	208
No. 9, September, 1929	-----	504, 505
No. 10, October, 1929	-----	504
No. 11, November, 1929	-----	808, 809
No. 12, December, 1929	-----	808
Supplement 32, 1929	-----	505
Supplement 33, 1930	-----	611
Climatological Data, volume 16—		
Nos. 5-6, May-June, 1929	-----	15
Nos. 7-8, July-August, 1929	-----	209
Nos. 9-10, September-October, 1929	-----	610
Report, 1929	-----	610

JOURNAL OF AGRICULTURAL RESEARCH

Volume 39—

No. 4, August 15, 1929	-----	11, 26, 48, 49, 51
No. 5, September 1, 1929	-----	24, 27, 48, 93
No. 6, September 15, 1929	-----	34, 50, 51, 55
No. 7, October 1, 1929	-----	320, 330, 341, 347, 391, 398
No. 8, October 15, 1929	-----	340, 348, 350
No. 9, November 1, 1929	-----	420, 442
No. 10, November 15, 1929	-----	421, 434, 439, 443, 470
No. 11, December 1, 1929	-----	419, 441, 443, 444, 455
No. 12, December 15, 1929	-----	509, 510, 534, 535

Volume 40—

No. 1, January 1, 1930	-----	634, 646, 656, 657, 670
No. 2, January 15, 1930	-----	721, 747, 748, 750, 766
No. 3, February 1, 1930	-----	819, 820, 846, 847, 862, 863, 876, 879
No. 4, February 15, 1930	-----	802, 831, 846, 849, 860, 876

EXPERIMENT STATION RECORD

VOL. 62

JANUARY, 1930

No. 1

The forty-third convention of the Association of Land-Grant Colleges and Universities, held in Chicago November 12-14, 1929, once again found that body alert, forward looking, and progressive. Although representatives of the constituent institutions have been meeting regularly since 1887, the tendency toward a static state sometimes encountered in organizations of advancing years seemed little in evidence. Seldom has less time been given to reminiscence and retrospect, and perhaps even more seldom have there been such abundant indications that the association is thinking in terms of its own day. One general session was devoted to an important conference with the newly appointed Federal Farm Board, and a second mainly to a consideration of the relations of the land-grant institutions to developments in radio broadcasting. A report was given before the executive body by the new standing committee on aeronautics. Similar innovations met the eye at other points in the program, and in some sessions the very terminology would have been more or less incomprehensible even a decade ago.

Obviously the scene and the actors are ever changing. The land-grant institutions of 1930 are far removed from their beginnings, not merely in years but in development, accomplishments, and notably in their influence and relative standing in the nation. Once almost negligible factors in the advancement of agriculture and education, they are now recognized as substantial contributors to progress in both these fields and as agencies to be looked to confidently for assistance and leadership in the solution of current problems.

As is usual at meetings in Chicago, the attendance was large and representative. From many of the institutions complete delegations of the president, the deans of agriculture and engineering, the directors of research and extension, and the heads of home economics activities, together with not a few other members of the staffs, were present. The extension forces seemed especially numerous, but the experiment station directors were also strongly in evidence, their roster including all of the stations unrepresented the previous year. Interest was well sustained throughout the sessions, the attendance

frequently taxing the capacity of what were on the whole the most adequate accommodations available for many years.

The auxiliary societies and other groups meeting during the week were the same as in 1928, and substantially the same division of time was followed. The American Association for the Advancement of Agricultural Teaching was in session on the preceding day, holding one meeting jointly with the subsection of resident teaching, and the American Association of Soil Survey Workers met on November 12 and 13. Later in the week came the American Society of Agronomy and the National Association of State Universities, each of whose sessions conflicted with those of the land-grant colleges' final day. Some criticism was expressed of these arrangements, and a change was authorized by the executive body whereby the Association of Land-Grant Colleges and Universities will begin its 1930 convention on Monday and end on Wednesday, a day earlier than of late. The immediate advantage sought in this shift is the avoidance of overlapping with the National Association of State Universities, many of whose members are the presidents or other official representatives of their institutions in both associations.

The arrangement of the association program also followed the general plan of 1928. A second opportunity was given to try out the two-session plan for the subsections of resident teaching, experiment station work, and extension work in the section of agriculture. The desired end of promoting discussions in the subsections was again well attained by this means, notably in the experiment station group where over an hour was utilized for an unusually profitable exchange of views by a large number of directors on the subject of station publications. The curtailed joint program of the section on agriculture scheduled only a single paper exclusively on research as compared with a former full session, but at least one other paper, a discussion of the relation of agricultural colleges to commercial agricultural workers, was of general appeal, and the net result was undoubtedly to provide more time for detailed consideration of research matters during the convention as a whole than was commonly available under the previous arrangement.

A more serious difficulty which developed was the presentation in some of the subsection programs of papers of direct interest to other groups meeting at the same hour. One of these was a discussion of fellowships and their contribution to research, by Dean H. L. Russell of Wisconsin, before the subsection of resident teaching, which paralleled important committee reports before the station subsection. This difficulty, it would seem, could have been obviated by presenting Dean Russell's paper before a joint session, perhaps by exchange of position with the paper there given on the Results

of a Study of Student Enrollment in Agriculture, by another member of the Wisconsin staff. However, a complete coordination of programs is exceedingly difficult of attainment, and the results as a whole indicated little acute dissatisfaction.

The three general sessions of the association were devoted almost exclusively to addresses. The reports of the executive committee were confined largely to current convention announcements, and those of other committees were again read before the smaller groups immediately concerned or in many cases behind closed doors directly to the executive body. On the other hand, the announcement by the president of his committee appointments at the first general session was an innovation which was not only informative but facilitated the organization of many committees while the convention was still in progress. Little else, however, was attempted to enlighten those in attendance who were not members of the executive body. Most of the matters of business, including the election of the new officers, were as usual not decided until after the general sessions had finally adjourned. Granting that under the present constitution the executive body is accountable to the constituent institutions and not to the individuals who may be attending the convention, it seems unfortunate that so large a proportion of those who have assembled have no direct means of learning before departure what has been done on numerous questions which are of considerable general interest.

The presidential address was given by Dean Anson Marston of Iowa under the title of National Aspects of Land-Grant Colleges. In this address the obligations and responsibilities of the institutions as component units in a great national system were especially emphasized. It was pointed out that they were in a position to render unique assistance to various departments of the Federal Government from time to time in the solution of national problems. As a means of promoting such activities and unifying the work of the institutions, the establishment of a permanent office in Washington was advocated. Ultimately this office, it was suggested, might constitute the nucleus of a national land-grant college and university institute.

Dean Marston reviewed the successive acts making Federal contributions to the land-grant institutions and maintained that Federal participation is still incomplete since no provision has been made for a system of engineering experiment stations. Already no fewer than 36 States are supporting such stations on their own initiative, and since their work, like that of the agricultural experiment stations, can never be limited by State lines, their organization on a Federal basis was believed to be one of the outstanding needs of the day.

Subsequently this question again received the attention of the executive body, and the attitude of the previous year favoring legislative priority was reaffirmed.

Another speaker who dealt with governmental relationships, though from a quite different angle, was Dr. Eugene Davenport, formerly dean of the College of Agriculture of the University of Illinois and director of the Illinois Station. Dean Davenport deprecated the attempts from time to time of governors and other State officials to coerce the land-grant colleges by trustee appointments and removals, dictation as to the purchases of supplies, or the kind and amount of printing, and the arbitrary regulation of travel. The colleges, in his view, are in no sense a part of the State Government, but extra-governmental enterprises the responsibility for which rests upon those in immediate charge, and he contended with undiminished vigor and earnestness that the increasing encroachments upon their independence in not a few of the States present an issue which needs immediate adjustment.

For the closing moments of the first general session there was scheduled a memorial address by Dr. E. W. Allen, chief of the Office of Experiment Stations, in honor of his predecessor and long-time associate, Dr. A. C. True. The sudden death of Dr. Allen on the previous evening made of the occasion a double memorial. Dr. Allen's paper was impressively delivered by Dr. A. F. Woods, Director of Scientific Work of the U. S. Department of Agriculture, and was followed by a remarkably appreciative and sympathetic tribute to Dr. Allen by Dean J. L. Hills of Vermont. Thus together, as so often in the many years of their intimate and influential relations with the association, the names of True and Allen were given high honor at its hands, and inscribed on its final records of those who have spent their lives effectively and well in the furtherance of the cause of agricultural education and research in this country.

Although the absence from the convention of these and other familiar faces cast its inevitable shadow, a number of other eminent national figures appeared on the program for the first time and were made duly welcome. Prominent among these was Hon. Arthur M. Hyde, Secretary of Agriculture. Secretary Hyde was in attendance both by virtue of his position as head of the Department of Agriculture and as an ex officio member of the new Federal Farm Board, and in his address he dealt mainly with the existing agricultural situation. This condition he considered to be one of overexpansion, caused in part by the very efficiency of the American farmer and his acceptance and application of the results of invention and experimentation. As he pointed out, research in the realm of pure science ought not to lag; but "our immediate concern is not to stimulate

greater production. We need to avoid overproduction; we need to seek out and make practical application of what we already know; we need to make research for new uses of present products, for economic uses for agricultural waste, for profitable uses for by-products of the farm. We need to place greater emphasis upon the economic side of agriculture, to search out for ourselves and through our extension service and other agencies to spread knowledge of the economic and competitive position of agriculture, of the probable supply and demand, foreign and domestic, of sound farm management, of cooperative marketing, of the significance and use of the *Agricultural Outlook* reports, and of data on the intention to plant and breed, secured from the farmers through timely surveys. We need also to give to the farmer assistance in the practically virgin field of farm finance, farm credit, farm insurance, and rural taxation."

The greatest need at the present time, Secretary Hyde went on to say, is for trained men in the various phases of economic research. "Strengthening our economic teaching, our extension work in economics, our research work in the economic field, seems to me to be the main problem which lies before us in the next few years if we are to be of vital assistance to agriculture." More specifically he pleaded for aid in fostering cooperative marketing and other forms of joint action among farmers. "In research for sound and economic forms of organization, in encouraging and creating the cooperative type of mind among farmers, in affording sound, unselfish and informed leadership for the movement, there is not only a great need for this aid of the American colleges of agriculture, but there is an inspiring challenge to their ability, their loyalty, and their devotion."

The enlarged opportunities for service opened to the colleges by the *Agricultural Marketing Act* were indicated by the other members of the *Federal Farm Board* present at the conference to develop a cooperative educational program which occupied most of the final session. The holding of this conference, attended by the chairman and all but two members of the entire board, was in itself a marked recognition of the association as a potentially powerful ally in view of the expressed policy of the board and its members to remain in Washington during the present emergency for close concentration on its task and to decline substantially all speaking engagements. Supplementing and reenforcing as it did a preliminary conference in Washington in September of the board and representatives of the association at which the services of the agricultural colleges and their extension organizations were proffered and accepted, there were many indications that the occasion was deemed remarkably helpful to all concerned. Provision was made for facilitating further

cooperation by the association through the designating of a special advisory committee to cooperate with the board. This committee consists of the executive committee supplemented by President T. O. Walton of Texas, Dean A. R. Mann of New York, and Extension Directors L. N. Duncan of Alabama, P. V. Maris of Oregon, and R. K. Bliss of Iowa.

One specific service to which the board drew attention was that of fostering interest in efficient cooperative marketing associations and their amalgamation into suitably indorsed national sales organizations. As was made clear in a paper before the section on agriculture by Dr. C. W. Warburton, U. S. D. A. Director of Extension Work, much has already been accomplished in the first of these objectives. In the last year, according to reports of extension agencies, assistance was given by them in organizing 942 cooperative purchasing or marketing associations, with 83,668 members, and county extension workers cooperated with 2,269 associations previously organized and enrolling 415,594 members. Director Warburton pointed out, however, that while it is the duty of every extension employee to give his or her support to the cooperative associations when properly organized and managed, it is equally a duty "to say a word of caution or even to condemn unwise ventures in cooperation or unwise or extravagant leadership." Moreover, he believed that often the county agent "can render quite as much service to a cooperative by helping the farmers to know what to produce, how to produce it, and how to put it in shape for market as by giving direct service to the marketing organization," itself.

Another Federal agency with which the association has long enjoyed close and cordial relations is the U. S. Department of the Interior, represented at the convention by the newly appointed Commissioner of Education, Mr. William J. Cooper. Commissioner Cooper devoted himself largely in his address to an explanation of the changes under way in the department whereby its Bureau of Education has been rechristened the Office of Education with considerable reorganization of its activities. Under this plan the statistical work will be handled largely as in the past, but among the major groups will be a division of collegiate and professional education. This division will be headed by Dr. A. J. Klein, of the former division of higher education, and will complete the land-grant college survey now under way, although major surveys in the future, including that on secondary schools now being outlined, will be headed directly by the commissioner himself. The ultimate purpose of the reorganization was set forth as the elimination of numerous noneducational and administrative functions, such as the management of the Alaskan reindeer herd, and the undertaking of additional educational

research and advisory work. As to this phase, attention was directed to the series of studies which the American Council of Education is making through a committee into the entire educational situation. The Office of Education is to cooperate actively in this work, and a special advisory committee from the association was subsequently appointed, of which President G. W. Rightmire, of Ohio, is chairman, together with Presidents R. D. Hetzel of Pennsylvania, W. J. Kerr of Oregon, F. L. McVey of Kentucky, J. J. Tigert of Florida, G. A. Works of Connecticut, and R. A. Pearson of Maryland.

For several years the association has been studying through its standing committee on the radio problem some of the relations of this comparatively new means of communication to the dissemination of information by the land-grant colleges. Most of these institutions are making use of radio broadcasting in greater or lesser degree, and there is considerable interest as to its possibilities and limitations. Advantage was taken of the opportunity afforded by meeting in Chicago to learn something as to commercial broadcasting, which of late has been by far the dominant occupant of the air. Mr. William F. Hedges of Station WMAQ, operated by the Chicago Daily News, and Mr. Frank Mullin, agricultural director of the National Broadcasting Company, discussed the existing situation, giving much practical information based on their experience in such matters as the kind of educational program which seems to make the greatest appeal, some of the legal and economic phases of the subject, and the relative advantages of utilizing commercial and independent stations in broadcasting. Their addresses were followed by a specific discussion of the use of radio by land-grant institutions by President F. D. Farrell, of Kansas. Describing himself as an early skeptic in the matter, President Farrell expressed his increasing conviction that radio broadcasting affords a practical and useful means of contact with the 1,500,000 farmers owning receiving sets, and that serious efforts should be made to secure and retain for the colleges at least a privileged legal status in the field as public educational agencies.

As usual, the sectional and subsectional programs took up many matters regarding instruction, extension, and research, and their papers were rather evenly divided between the three fields. Following the practice of recent years, discussion of the research aspects is reserved for a later issue of the *Record*. Space considerations preclude detailed analysis of the contributions in other subjects, but special mention should be made of the numerous papers looking toward the improvement of college teaching, some trends in modern education, a discussion of the duties and responsibilities of the extension director, the regulation of leave for professional improvement

for extension workers, the influence to date of Smith-Lever extension work on rural life in the United States and a program for the future, and a novel and stimulating discussion of self-education, presented under the cryptic title of *Read While You Run*. This last-named paper, given by Dean E. M. Freeman of Minnesota, developed in the author's characteristically trenchant style "the amazing fact that self-education not only still thrives but is expanding at a rate and in a manner which bids fair in the days not far ahead to revolutionize our whole educational structure," and held that, despite "intellectual rickets, economic myopia, and countless types of educational indigestion, many achieve real intellectual and professional growth." Dean Freeman warmly commended the definiteness of purpose of this type of students, and suggested that the "injection of large doses of self-education principles into college administration and teaching" might help to simplify such college difficulties as vocational guidance and orientation, inadequate preparation, and inability to cope with extraneous interests. "Make the college student more completely responsible for his own education and you will help him to solve with a clearer vision and better judgment these perplexing problems."

The presidency of the association for the ensuing year was bestowed upon a representative of the Southeastern States, President A. M. Soule of Georgia, while the Northwest was recognized by the choice of President Alfred Atkinson of Montana as vice president. Dean T. P. Cooper of Kentucky replaced Dean C. A. McCue of Delaware as secretary-treasurer, with the understanding that Dean McCue would edit the proceedings of the 1929 convention. The association continued to avail itself of the wide knowledge and long experience of Deans J. L. Hills of Vermont and F. B. Mumford of Missouri by their respective retention as assistant treasurer and member of the executive committee.

Decision as to the week during which the 1930 convention will be held was as usual intrusted to the executive committee. Under the plan in operation for several years the convention is scheduled to be held in Washington, D. C.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

The proteins of meat, A. G. HOGAN, W. S. RITCHIE, and R. BOUCHER (*Missouri Sta. Bul.* 272 (1929), pp. 19, 20).—The use of three methods for the separation of the albumin and globulin of muscle is noted. The first of these procedures consisted in the saturation of the material with sodium chloride, the second involving dialysis, while in the third process ultra-violet irradiation was tried. An attempt has been made to refine these methods so that more consistent results could be obtained. The necessity for controlling the H-ion concentration was observed, a pH value of about 6 showing itself most satisfactory in the precipitation of the globulin. A table indicates the nature of the separations secured.

The rate of acid production in heated milk, E. O. WHITTIER and A. G. BENTON (*Jour. Dairy Sci.*, 10 (1927), No. 4, p. 343, fig. 1).—This note is a contribution from the U. S. D. A. Bureau of Dairy Industry presenting a curve by means of which is shown the observed effect of heating at temperatures ranging from 90 to 120° C. upon the time rate of acid formation, here plotted as cubic centimeters of N/10 acid per hour.

Chemical studies of grape pigments.—V, anthocyanins in Ives grapes, R. L. SHREINER and E. J. ANDERSON (*New York State Sta. Tech. Bul.* 152 (1929), pp. 11; also in *Jour. Biol. Chem.*, 80 (1928), No. 2, pp. 743-752).—The anthocyanin pigment of the Ives grape was isolated and found to consist of a nonglucosidic constituent or anthocyanidin, a monoglucoside of dimethoxydelphinidin (identical with oenidin), a monoglucoside of a monomethoxydelphinidin, and finally, some derivative of p-hydroxycinnamic acid. When the anthocyanidin acetate was oxidized syringic acid alone was produced.

Experimental details, beginning with the cleaning and extraction of the skins of 500 lbs. of freshly picked ripe grapes, are noted, with the inclusion of analyses, the preparation and properties of derivatives, other means of identification, etc.

This investigation concludes the series previously noted (*E. S. R.*, 50, p. 410; 57, p. 502; 60, p. 709).

Citrus products, Part I, J. B. McNAIR (*Field Mus. Nat. Hist. [Chicago] Pub., Bot. Ser.*, 6 (1926), No. 1, pp. XII+212, pls. 7, figs. 19).—The following phases of the subject are dealt with somewhat thoroughly: Citrus production and the citrus products industry; products from the rind—essential oils, pectin, etc.; products from the pulp, seeds, flowers, leaves, and stems; and products in which the entire fruit is used.

The types of organisms found in spoiled tomato products, C. S. PEDERSON (*New York State Sta. Tech. Bul.* 150 (1929), pp. 46, figs. 16).—Of organisms isolated as 266 cultures from 83 samples of various tinned or bottled tomato products, 11 were found to be strains of *Lactobacillus lycopersici*, 27 were strains of *L. gayoni*, 69 were strains of *Leuconostoc pleofructi*, 45 were strains of *Lactobacillus pentoaceticus*, 33 strains of *L. mannitopoeum*, and 68 strains of

L. plantarum, while 13 cultures represented miscellaneous yeasts and spore-forming bacteria not identified.

Heat resistance studies showed the entire group to be unable to survive the temperatures ordinarily used in the bottling of catsup or in the tinning of the other products.

Photomicrographs of many of the forms isolated, together with full descriptions and condensed statements of experimental methods employed, are given, the fermentation characteristics of a considerable number of cultures of each of six species of the bacteria isolated from tomato products with respect to 18 carbohydrates and some related substances are tabulated, the temperature range for growth as indicated by the H-ion concentration attained is shown graphically for six species, and other related observations are recorded.

The fermentation of glucose, fructose, and arabinose by organisms from spoiled tomato products, C. S. PEDERSON (*New York State Sta. Tech. Bul.* 151 (1929), pp. 22).—A study was made of the fermentative action upon glucose, fructose, and arabinose of representative cultures of *Lactobacillus plantarum*, *L. lycopersici*, *L. gayoni*, *L. mannitopoeum*, and *L. pentoaceticus*, and of *Leuconostoc pleofructi*.

L. plantarum produced only traces of substances other than lactic acid. The remaining species produced lactic and acetic acids, ethyl alcohol, and carbon dioxide from glucose practically in the same proportions. Except in the case of *L. pleofructi*, which yielded the levorotatory form, the lactic acid produced by the organisms studied was optically inactive.

From fructose the organisms studied, with the exception of *L. plantarum*, produced mannitol, lactic acid, and acetic acid, together with carbon dioxide. It was found that mannitol might also be fermented, with the formation of ethyl alcohol as an end product, and it is noted that "the results substantiate the theory of Peterson and Fred [E. S. R., 42, p. 709] in regard to mannitol formation from fructose."

From arabinose the products were mainly lactic acid and acetic acid, with carbon dioxide in small quantity.

Control of spoilage in tomato products, C. S. PEDERSON and R. S. BREED (*New York State Sta. Bul.* 570 (1929), pp. 16).—Samples of spoiled tomato products from various homes and from canning companies were examined, the causative organisms were isolated, and the conditions under which the products had been canned were studied thoroughly in an attempt to discover the causes of the spoilage and methods of control.

These studies showed that spoilage of tomato products is caused, with very few exceptions, by bacteria belonging to the lactic acid types, and that those ordinarily found belong to one of six types or species. A few yeasts and spore-forming bacteria occurred but caused little trouble in these products.

"The lactic acid bacteria ferment the sugars present and produce lactic and acetic acids, carbon dioxide, alcohol, and mannitol. None of these products are poisonous, but they produce disagreeable flat and sour flavors in most cases. In some cases the product may be slimy, but this sliminess is also not poisonous.

"With very few exceptions, the organisms are not resistant to the heat ordinarily used in canning. Losses are caused by carelessness in cleaning and sorting tomatoes, and by improper methods of operating machinery used in canning and bottling, particularly where hot products are placed in containers that are not to be resterilized afterwards. Likewise, careless methods of handling and storing 5-gal. cans and the use of wooden vats and barrels contribute to a total loss from spoilage that still is much too large."

Suggestions are made regarding methods of avoiding losses from this source.

Relation of temperature of fermentation to quality of sauerkraut. E. A. MARTEN, W. H. PETERSON, E. B. FRED, and W. E. VAUGHN (*Jour. Agr. Research [U. S.]*, 39 (1929), No. 4, pp. 285-292, figs. 3).—As a result of these experiments of the Wisconsin Experiment Station the conclusion was reached that the quality of a sauerkraut depends largely upon the temperature at which the fermentation takes place, and that the best results are obtained when the temperature lies between 60 and 65° F. High temperatures were observed to favor the production of a soft sauerkraut of a pink color.

A temperature rise of from 3 to 5° was observed during the first eight days in fermentation vats held at temperatures above that of the air about them. This increase in temperature was found to coincide with the greatest bacterial activity and is believed to have resulted from that fermentation.

This study continues and extends previously noted work (E. S. R., 58, p. 712) of the station.

A portable pH apparatus with micro-analytical electrode and saturated calomel electrode. A. ITANO (*Ber. Ohara Inst. Landw. Forsch.*, 4 (1929), No. 1, pp. 19-26, pl. 1, figs. 2).—Following a brief introduction the paper is presented in three parts.

I. *A portable pH apparatus (Itano).*—The circuit of the apparatus described and figured is of the voltmeter-galvanometer type and includes a commutator switch, button contact, the usual balancing resistance, etc., with a dry cell as the source of working current. The reference electrode is platinum in saturated quinhydrone 0.01 N with respect to hydrochloric acid and 0.09 N with respect to potassium chloride, this half cell being connected through an agar bridge tube to an intermediate closed vessel of saturated potassium chloride solution, while a second agar bridge tube makes connection with the quinhydrone measuring electrode.

II. *Electrode for micro-pH determination.*—A microquinhydrone electrode (capable of dealing with samples of 0.02 cc. or less) has for the electrode vessel a short piece of glass tubing drawn to form a short narrow capillary and bent at the constriction into a U-shape. A narrow-tipped agar bridge tube is placed in one (shortened) arm of the U so that its tip reaches nearly to the bottom of the bend, while the tip of a platinum wire mounted in a small glass tube reaches nearly to the bottom of the U from the other side. Quinhydrone and the minute quantity of sample required are placed in the bottom of the constriction bend and thoroughly mixed, according to the technic described, the platinum wire and the agar bridge, removed to permit of the introduction of the sample, are replaced and connected, and the reading is taken in the usual way.

III. *Investigation on a saturated calomel electrode.*—This part of the paper notes a study of the saturated calomel half cell, the potential of which was found to be 0.2514 volt at 18° C.

The apparatus as described in the early part of the paper is said to be inexpensive, readily portable, and of a low cost for maintenance. The comparative figures given to show the agreement between the author's apparatus and the Type K potentiometer indicate discrepancies between the two instruments amounting in general to not more than 0.1 pH unit.

The gauze catalyst in ammonia oxidation. G. A. PERLEY and M. W. VARELL (*Indus. and Engin. Chem.*, 21 (1929), No. 3, pp. 222, 223).—This concise report of research upon the relation of the form of the platinum gauze catalyst to efficiency and capacity in the oxidation of synthetic ammonia is a contribution from the University of New Hampshire.

A condensed discussion of a considerable number of previous investigations is followed by an account of experimental work in which one group of seven trials brought the oxidation efficiency to 95.5 per cent. The authors were able to demonstrate (1) that a catalyst taking the form of a multiple layer of the platinum gauze has a greater capacity at a higher efficiency than does a single gauze, whether the layers are or are not in direct contact; (2) that the use of separated platinum gauze layers gives, with a preheated gas mixture, an oxidation efficiency nearly as great as that resulting from close contact of the gauze layers, but does not increase the capacity; and (3) that an intake gas flow of approximately 1.6 liters per square centimeter per minute (52 cu. ft. to the square foot), with a preheating of the gas mixture to 470° C., the contact time at the catalyst being thus made approximately 0.00019 second, gives the highest oxidation efficiency regardless of the contact or separation of the layers of the catalyst.

A test for water-soluble phosphorus; studies on water-soluble phosphorus in field soils, C. H. SPURWAY (*Michigan Sta. Tech. Bul. 101 (1929), pp. 25*).—A microchemical method for the estimation of the water-soluble phosphate content of soils was developed by the author on the basis of the reaction of Denigès (*E. S. R., 44, p. 611*).

The effects of silica on the reaction were eliminated by carrying out the reduction process in a strong nitric acid solution. "The ammonium molybdate reagent is prepared with nitric acid of sufficient strength so that when diluted with equal parts of soil extract the resulting mixture contains the proper concentration of acid. The technic Denigès is also further modified by stirring the nitric acid solution of ammonium phosphomolybdate with a piece of tin metal in order to reduce the molybdenum and produce the blue color in making the test. The piece of tin also takes the place of a solution of stannous chloride and thus simplifies the equipment."

The test requires: (1) Strips of white, medium weight paraffined paper, such as bread wrapper stock, cut about $\frac{3}{4}$ by $3\frac{1}{2}$ in. (2) A bottle of about 150 cc. capacity with rubber stopper and pipette dropper for water. Tap water or well water is preferred to distilled water "because the slight flocculating effect of well water aids in obtaining clear water extracts of the soils to be tested." (3) A molybdate reagent made by dissolving 5 gm. of phosphorus- and arsenic-free ammonium molybdate in 50 cc. of distilled water, with the aid of gentle heat if necessary, pouring this solution slowly and with stirring into 50 cc. of pure concentrated nitric acid, and diluting the mixture with 100 cc. of distilled water. This reagent must frequently be tested by a blank determination. If a blue color appears add from 3 to 5 cc. of nitric acid to the total quantity of the reagent, and if this fails to make the blank test satisfactory, prepare a fresh supply of the reagent. This reagent should be used from a glass-stoppered 30-cc. dropping bottle with ground-in pipette. (4) A tin pencil, or rod of pure tin, about $\frac{1}{8}$ by from 3 to 4 in. and pointed at one end like a slate pencil. The tin pencil required may be cast in suitably drawn glass tubes. (5) A color chart showing the colors given by 0.5, 1, 2, 3, 4, 7, 10, and 15 parts per million of phosphorus.

Following a statement of the method of making blank tests on the reagent and on the water used, the following description of the test on the actual soil sample is given:

"Fold a piece of the waxed paper once lengthwise and open to form a trough. Hold the folded paper between the thumb and forefinger of the left hand. With a knife blade, or small spatula, place some of the soil to be tested in the end of the paper trough close to the hand and then push the soil slightly away

from the hand with the point of the knife blade, or the tin pencil, in order to make a cavity behind the soil sample to receive the water used for extracting the soil. The soil sample should fill the paper trough to the top edges and extend about $\frac{3}{4}$ in. lengthwise on the paper. The soil should be mellow and friable and placed on the paper in a loose condition. During the testing operation care must be taken not to mix or puddle the soil in any way with the water.

"Drop the water into the paper trough back of the soil sample, slowly and carefully, allowing the soil to take up the water drop by drop, and controlling the movement of the water through the soil sample by tipping the open end of the paper slightly downward. The water must move slowly through the soil, not over or around it, otherwise clear extracts may not be obtained. When the clear soil extract appears at the outer or lower end of the soil sample, it is separated from the soil mass by touching the edge of the drop with the tip of the tin pencil and drawing a portion away to the outer end of the paper. Several of these drawing-out operations may be necessary in order to obtain a sufficient amount of the clear extract for making the test. When about a drop of the soil extract has been obtained and is held on the outer end of the paper, draw the drop off again onto a flat piece of the waxed paper. This second drawing operation aids in obtaining clearer soil extracts. Add to the drop of soil extract on the flat piece of paper an equal quantity of the molybdate reagent (these quantities can be estimated in drops with a little practice) and mix by stirring with the corner of a piece of the waxed paper, and then stir with the tip of the tin pencil for about 10 seconds. If phosphorus is present in the soil extract, within the accuracy of the test, a blue color develops and the intensity of this blue color is a measure of the quantity of phosphorus present in the soil extract up to the maximum color obtainable from the reaction."

Applying this method to a number of Michigan soils, the author reached the following among other conclusions: When the soil tested showed 0.5 part per million or less of phosphorus, phosphatic fertilizers produced crop increases. Soils of high phosphate-reverting power may hold phosphates where they are mixed with the soil by tillage. Muck soils retained most of the soluble phosphate in the plowed portion, but mineral soils permitted movement to lower levels. Ammonium sulfate and potassium chloride increased the solubility of the soil phosphates.

A field test for available phosphorus in soils, R. H. BRAY (*Illinois Sta. Bul.* 337 (1929), pp. 559-602, pl. 1, figs. 2).—Reviewing previously published forms of the application of the Deniges reaction (E. S. R., 44, p. 611), the author finds Spurway's form of the test, noted above, to give a color which fades rapidly and fails to indicate at all the presence of quantities of phosphate indicated either as "medium" or as "doubtful" by the form of the test here described. It is stated further that "in the case of soils testing 'high' by the method devised at this station it was possible to get a blue color but in most cases only after considerably more prolonged contact of soil with the extracting solution than is recommended by Spurway."

The solution required for the Illinois adaptation is made as follows: "Dissolve 100 gm. of highest purity ammonium molybdate, phosphate-free, in 850 cc. of distilled water. Filter the solution and cool it. Then add it slowly with constant stirring to a cold mixture of 1,700 cc. of concentrated hydrochloric acid (36 per cent) and 700 cc. of water. This is the stock solution. The solution as used for the test is made by diluting 120 cc. of the stock solution to 1,000 cc. with distilled water. In addition to the solution a small

tin rod as recommended by Spurway is required for the test. A piece of solder wire is quite satisfactory, although slower than pure tin in developing the blue color."

It is further noted that the acid concentration in this reagent has been worked out carefully, and that a material increase in the concentration of the acid will result in the failure of the color to appear at all, whereas a large decrease in the acidity will cause the test solution itself to give a blue color when stirred with the tin rod, even in the absence of phosphates.

"The test is made by shaking 1 part of soil with about 3 parts of the solution in a small test tube or vial. Only enough shaking to mix the soil and solution is required. When settled, after about five minutes, the soil should occupy about one-third of the tube and the solution two-thirds. The clear solution is then stirred gently with a tin rod and without disturbing the settled soil until maximum intensity of color develops. This requires from 10 to 20 seconds, depending upon the amount of phosphate present. The tin dissolves in the acid solution and brings about the reducing action necessary for the production of the blue color. The varying amounts of phosphate present are indicated by a series of increasing color intensities and shades. . . . The first is colorless; the second, light green; the third, greenish blue; and the fourth, medium blue."

The first of these reactions, "low," indicates available phosphorus deficient for average crop growth; the second, "doubtful," indicates uncertain adequacy; while the third and fourth, the "medium" and "high" tests, indicate phosphorus adequate for yields from average to high, according to the observations reported. A color chart showing the four degrees of color intensity discussed is included in the bulletin.

Yield data from a number of fields are tabulated in comparison with the test results.

A colorimetric method for the determination of butyric acid, R. J. ALLGEIER, W. H. PETERSON, and E. B. FRED (*Jour. Bact.*, 17 (1929), No. 2, pp. 79-87).—Noting the time-consuming character of the standard Duclaux method and the demand of this procedure for specially standardized apparatus, the authors of this contribution from the University of Wisconsin discuss briefly the requirement in the preliminary examination of large numbers of cultures for a butyric acid method more rapid than that of Duclaux, even if somewhat less precise. They give an account of an experimental study of a modification of the conditions of Dyer's form (*E. S. R.*, 37, p. 13) of the Agulhon qualitative color reaction for butyric acid to permit the use of the principle of the reaction named in an approximately colorimetric determination of butyric acid. The general principle in question is that of the conversion of the butyric acid into its copper salt, the extraction of this salt with an immiscible solvent (ether in the original Agulhon qualitative test), and, in the application of the reaction of the quantitative determination of butyric acid, a matching of the extract with standard extracts representing known quantities of butyric acid.

After a study of several copper salts, a solution of 85.26 gm. of cupric chloride dehydrated in 1,000 cc. of normal hydrochloric acid was selected as the most satisfactory copper reagent. Chloroform was chosen from among a number of immiscible solvents as giving, like ether, a maximum color intensity, while free from the emulsifying tendency of ether, and permitting because of its less extreme tendency to rapid evaporation, the preparation of permanent standards. Of the solvents tried, only carbon tetrachloride and carbon disulfide failed to extract a blue color.

The standard color tubes were made by the treatment, as in the determination, of known mixtures of 0.5 N sodium acetate and 0.5 N sodium butyrate (convenient methods for the accurate preparation of these solutions are given) with the copper reagent above noted. The aqueous mixtures were then extracted with chloroform under quantitative conditions, and the extracts were sealed into test tubes of uniform diameter and marked at the initial level of the liquid to permit the immediate detection of evaporation.

Figures obtained by the Duclaux method and by the procedure here outlined are shown to indicate the adequacy, for purpose of comparison, of the rapid colorimetric determination, 17 cultures of butyric acid producing bacteria being represented in the comparative results shown.

METEOROLOGY

Forest fire hazard as affected by weather conditions, forest type, and density of cover, J. A. MITCHELL (*Wisconsin Sta. Research Bul. 91* (1929), pp. 26, figs. 6).—A study, in cooperation with the Lake States Forest Experiment Station of the Forest Service, U. S. D. A., and the Wisconsin Conservation Commission, of the fire hazard conditions during the fall and spring fire seasons in jack pine and hardwood-hemlock forest areas in northern Wisconsin is reported.

Data were collected with reference to character, amount, and distribution of the principal forest fire fuels, the effect of weather conditions on their inflammability, and the modifying effect of forest cover. The results emphasize the controlling influence of precipitation and humidity, but also indicate the relation of wind movement, sunshine, and forest cover to fire hazard.

"Two-tenths of an inch or more of rain precludes the possibility of fires for the time being by rendering the principal fuels too wet to burn. Less amounts reduce the fire hazard to a greater or less extent, depending on the amount of moisture present in the fuels at the time. Relative humidity very largely controls the rate and extent of drying out of the various fuels between rains. In dry weather, therefore, it serves as an indication of the fire hazard to be expected. In general, fires are likely to occur when the relative humidity falls below 50 per cent, while 30 per cent and below indicates a high fire hazard. Humidity is normally highest at night and lowest between noon and 4 p. m. This explains why fires usually die down at night and burn hardest in the afternoon. In general, the humidity prevailing at 8 a. m. is near the mean for the day, while at 2 p. m. it approaches the minimum. The normal fall in relative humidity between 8 a. m. and 2 p. m. averages about 20 per cent. In settled weather, therefore, the humidity prevailing at 8 a. m. may be taken as an indication of conditions to be expected during the day."

The fire hazard was found to be "less in the forest than in the open and higher in pine stands than in hardwoods. Although a dense cover tends to reduce the effectiveness of precipitation by preventing about 20 per cent of the rainfall from reaching the forest floor, it materially reduces the fire hazard by slowing up evaporation."

Climatological data for the United States by sections, [May-June, 1929] (*U. S. Dept. Agr., Weather Bur. Climat. Data, 16* (1929), Nos. 5, pp. [199], pls. 3, figs. 3; 6, pp. [199], pls. 3, figs. 3).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for May and June, 1929.

Monthly Weather Review, [May-June, 1929] (*U. S. Mo. Weather Rev., 57* (1929), Nos. 5, pp. 179-229, pls. 13, figs. 24; 6, pp. 231-275, pls. 12, figs. 9).—

In addition to detailed summaries of meteorological and climatological data and weather conditions for May and June, 1929, and bibliographical information, notes, abstracts, and reviews, these numbers contain the following contributions:

No. 5.—Correlation between Rainfall and Run-off (illus.), by J. W. Shuman (pp. 179-184); Rainfall Persistency at San Juan, P. R., by C. L. Ray (pp. 184, 185); Flood Predictions from Storm Paths, Preflood River Stages, Precipitation Data, and Peak River Stages (illus.), by J. E. Stewart and E. T. Schuleen (pp. 186-192); Northers of the Gulf of Tehuantepec, by W. E. Hurd (pp. 192-194); Meteorological Program of the Seventh Cruise of the "Carnegie," 1928-1931 (illus.), by C. F. Brooks (pp. 194-196); An Unusual Lightning Flash (illus.), by A. McAdie (pp. 197, 198); and Weather Abnormalities in United States, II, III (illus.), by A. J. Henry (pp. 198-204).

No. 6.—Sounding-Balloon Observations Made at Groesbeck, Tex., during the International Month, October, 1927 (illus.), by L. T. Samuels (pp. 231-246); The Passing of Signal Service, Weather Bureau Electric Telegraph and Cable Systems, by A. J. Henry (pp. 246, 247); Effect of Clouds on the Surface Temperature, by W. J. Humphreys (pp. 247, 248); Winter of 1928-29 in Europe, by W. R. Stevens (pp. 248, 249); Waterspouts in the Strait of Malacca (illus.) (p. 249); Waterspout on Hillsborough Bay, Tampa, Fla., April 2, 1929 (illus.), by W. E. Hurd (pp. 249, 250); Evidence of Prolonged Droughts on the Columbia Plateau Prior to White Settlement (illus.), by O. W. Freeman (pp. 250, 251); Agro-Climatic Conditions in Russia, by W. v. Poletika, trans. by W. W. Reed (p. 251) (E. S. R., 61, p. 416); The Tornadoes of May 2 in Virginia, by H. A. Frise (pp. 252, 253); The Tropical Storm of June 23, 1929, by W. P. Day (p. 253); and Harry Crawford Frankenfeld, 1862-1929, by A. J. Henry (p. 254).

SOILS—FERTILIZERS

[Soils and fertilizer work in Missouri] (*Missouri Sta. Bul. 272 (1929)*, pp. 83-85, 86-91, figs. 3).—A group of miscellaneous notes on current tests and other work is presented.

Soil erosion, M. F. Miller and H. H. Krusekopf.—In 1927 erosion under corn exceeded that under soybeans by 50 per cent, but, according to all the data available, the average erosion of the soybean plat was as bad as that of the plat in continuous corn.

The greatest losses in the erosion waters were those of calcium, sulfur, magnesium, and potassium in the order in which the elements are named. Comparatively, the nitrogen loss was small. The percentage of run-off was approximately the same from plats of 6° slope as from plats with 8.5°, but the slightly greater slope underwent more than twice the erosion loss.

Commercial fertilizer on corn, M. F. Miller and H. H. Krusekopf.—No single factor could be shown to determine the return from the use of fertilizers. Seasons particularly favorable to high yields did not always give the maximum returns from the use of fertilizers. As against an average increase of 10.7 bu. for the preceding four years, the average increase for the year here reported was but 4.6 bu.

Nitrogen depletion in soils under different systems of soil treatment and management, M. F. Miller, W. A. Albrecht, and R. E. Uhland.—"From the results secured thus far, it was indicated that upland soils in central Missouri, even under the best systems of management, continued to lose nitrogen until a level was reached much lower than was anticipated. Nitrogen turnover seems, therefore, of greater importance than the maintenance of a high nitrogen level."

For tests starting with a low nitrogen level several cropping systems and soil treatments have been begun on plats from which the surface soil had first been removed. A study of climate-nitrogen relations already noted from another source (E. S. R., 60, p. 118) is here mentioned. Mining and fertilizer tests with soybeans, alfalfa, and sweetclover are also noted. Lime caused a very marked increase in the protein content of soybeans and alfalfa. Cutting sweetclover on October 7 increased winterkilling 21 per cent over cutting November 9, and the spring yield was only 4 per cent as large. Growing sweetclover with wheat and turning under for corn returned from 100 to 155 lbs. of nitrogen per acre without the loss of the use of the land and at a cost of only the price of the seed.

Studies on the longevity of B. radicicola in the soil, W. A. Albrecht and L. M. Turk.—The effect of artificial and of ultra-violet light on the organism in thin layers of soil was tested. The organism appeared not easily killed.

The making of artificial manure from straw, W. A. Albrecht.—Farm trials (E. S. R., 58, p. 721) were repeated, using low flat piles of straw, and depending on the rainfall for moisture. Adding chemicals to the straw during threshing, the manure could be used for top-dressing wheat in November. "This process fitted well into the farming scheme, and the treatment on the wheat gave improved winter conditions for this crop." Each ton of straw produced more than 3 tons of manure. Tests were also made with chopped and unchopped cornstalks and the waste from cotton gins.

Investigations on outlying soil experiment fields, M. F. Miller, H. H. Krusekopf, and R. Hockensmith.—Field tests with various combinations of fertilizers, lime, and manure are noted.

Ammonia and nitrate production in soils by bacteria, W. A. Albrecht.—Soils from continuous wheat plats were tested in the laboratory for ammonia and nitrates at biweekly intervals for three months, comparison being made of the effects of lime or organic matter (sweetclover) and of the two combined, with a check test untreated. Lime increased the ammonia and nitrate figures for the soil from the ammonium sulfate plat more than for sodium nitrate treated soil. The organic matter gave a more sudden ammonia increase in the soil from the sodium nitrate plat than in that from the ammonium sulfate plat, the nitrate figure showing little difference between the two plats. Lime and organic matter together induced a greater production both of ammonia and nitrates in the soil from the sodium nitrate treated plat. Mulching with straw resulted in a nitrogen shortage with corn even though 2 tons of legume tops were turned under per acre.

Colloidal material in Missouri soils, R. Bradfield and H. Jenny.—The exchangeable acidity was estimated by the potassium nitrate and the calcium acetate methods. The poorer soils had in general more exchangeable acidity and less exchangeable bases.

By the use of electrodialysis, Grundy silt loam was found to contain 10 to 12 milliequivalents of bases in 100 gm. of the soil, while the poorer Putnam silt loam had but from 4 to 7 milliequivalents per 100 gm. Phosphate absorption by soil colloids appeared to be determined largely by the H-ion concentration, maximum retention having been noted at pH 3.5 to 4. Electrodialyzed peat humus colloid showed the same type of retention curve but a greater absorption.

Use of potassium nitrate method as an indicator of lime requirement, M. F. Miller.—The relation of methods for the estimation of soil acidity to the responses obtained from liming is briefly discussed, and the statement is made

that "the determination of the so-called exchange acidity by means of the potassium nitrate method was a better indicator of lime response than the Truog test or the pH value." The method was not so satisfactory for soils of low acidity, however, as for those giving a high figure.

[**Soil and fertilizer studies at the Nevada Station**] (*Nevada Sta. Rpt. 1928*, pp. 26, 27, 29, 30).—Three studies are noted.

Soil fertility (pp. 26, 27).—Soil and fertilizer experiments are very briefly noted. Phosphates had in general the greatest effect, though in certain co-operative trials ammonium sulfate proved of value in the treatment of peach trees.

An attempt to determine the value of nitrogen in the unhumified soil organic matter of gypsum and allied desert soils of the Las Vegas Valley of southern Nevada, R. Stewart and G. Hardman (pp. 29, 30).—A complete analysis of Moapa Valley soil samples taken for nitrogen value studies upon unhumified organic matter was made, and various procedures for the securing of humus-free soil were given experimental trial. It was found necessary to treat the soil with hydrochloric acid to extract organically combined bases, following which dilute ammonia was used for the removal of the humus. These treatments having rendered the soil impervious, the mixing of the soil with sand and the provision of a sand core in the percolator was tried, as was also the use of the centrifuge, with a view to the separation of the solution from the soil after a more or less prolonged contact. Neither of these devices serving the purpose, success was attained finally by the extraction of successively small quantities of the soil, about 10 gm. in each portion, by which means about 1 kg. of the required humus-free soil was obtained. The selection and analysis of samples of dolomite, limestone, and gypsum required for the purpose of returning to the soil in their naturally occurring forms the minerals removed in the process of getting rid of the humus is noted also, together with the carrying out of a study of the nitrifying power of the humus-free soil.

A study of the chemical and physical phenomena of the so-called "slick spots," impermeable areas in the gypsum soils and allied soils of the Moapa and Las Vegas Valleys of southern Nevada, R. Stewart and G. Hardman (p. 30).—In making of complete analyses of slick-spot soils from two localities, the Moapa Valley soil was found practically free from water-soluble carbonate and bicarbonate, with but 0.0075 per cent of sodium nitrate. It was concluded that neither "black alkali" nor "niter soil" condition accounted for the existence of the slick spots. "The trouble here is apparently not due to ordinary alkali conditions but to something entirely different."

[**Soil Survey Reports, 1925 series**] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1925, Nos. 4, pp. 48, pls. 2, fig. 1, map 1; 5, pp. 35, fig. 1, map 1; 6, pp. 33, pls. 2, fig. 1, map 1*).—Surveys of the Chico area, Calif., of Howard County, Iowa, and of the Soda Springs-Bancroft area, Idaho, are here noted.

No. 4. *Soil survey of the Chico area, California*, E. B. Watson et al.—The Chico area, north-central California, contains 307,200 acres of lands rising gradually from the flood plain of the Sacramento River eastward as far as agricultural land extends into the foothills of the Sierra Nevada, practically all of the drainage of the area being received by the Sacramento River.

Of the 20 series of 35 types classified in the present report Stockton clay adobe, 11.5 per cent of the total, and Vina loam with 9.2 per cent are the most extensive single types. Scab land, 16.5 per cent, and 6.8 per cent of rough broken and stony land, not agricultural but utilizable for grazing and the production of fuel wood, are listed unclassified.

This survey was made in cooperation with the California Experiment Station.

No. 5. *Soil survey of Howard County, Iowa*, C. L. Orrben and A. L. Gray.—Howard County, northeastern Iowa, possesses an area of 299,520 acres of moderately hilly lands, the drainage system of which includes the Upper Iowa and Turkey Rivers and other streams.

Individual soil types to the number of 18 were found and are here mapped and described as 12 series, Carrington silt loam 25.9 per cent of the total area surveyed, Carrington loam 21.9 per cent, and Clyde silt loam 16.1 per cent comprising the types of largest aggregate area.

This survey was made in cooperation with the Iowa Experiment Station.

No. 6. *Soil survey of the Soda Springs-Bancroft area, Idaho*, F. O. Youngs et al.—The Soda Springs-Bancroft area, southeastern Idaho, contains lands aggregating 333,440 acres and consisting physiographically of two large valleys inclosed by three mountain ranges, the drainage being provided by the Bear, Portneuf, and Blackfoot Rivers. The soils mapped and described in the area comprise 11 series of 12 types, of which Ritzville silt loam, 30.2 per cent, and Walla Walla silt loam, 10.8 per cent of the entire area surveyed, are the most extensive. There is also 33.4 per cent of rough mountainous land, 2.3 per cent of rough broken and stony land, and 9.3 per cent of scab land, listed unclassified. Moisture equivalent for 12 important types are tabulated.

This survey was made in cooperation with the Idaho College of Agriculture and Experiment Station.

Soils, J. H. CRAWFORD (*Idaho Sta. Bul. 158 (1928), pp. 11-13*).—The main soil types in the logged-off areas of northern Idaho are stated to be classifiable into the groups rolling wind-blown soils, bench soils, alluvial river bottom, gravelly and sandy soils, and peat and muck soils, together with scab lands and rough mountainous lands.

The rolling wind-blown soils are fairly well supplied with plant food elements and capable of supporting good crops of alfalfa, clover, and other legumes, as well as wheat and other grains. The bench soils "constitute the most general farming type of the whole area." The alluvial soils "are the most fertile in the cut-over district and are found in the bottom soils of the various streams." Some of the gravelly and sandy group are distinctly fertile, and the peat and muck soils are said to furnish a minor portion of the agricultural lands.

Soil Survey of Iowa.—Reports 56-59, W. H. STEVENSON, P. E. BROWN, ET AL. (*Iowa Sta. Soil Survey Rpts. 56 (1929), pp. 72 pl. 1, figs. 8; 57, pp. 72, pl. 1, figs. 6; 58, pp. 64, pl. 1, figs. 5; 59, pp. 64, pl. 1, figs. 6*).—Of the Iowa soil survey series, the four reports here noted deal with the soils of Delaware, Jones, Fremont, and Cherokee Counties, located, respectively, in the northeast, east central, southwest, and northwest sections of the State.

Delaware County contains 365,440 acres of soils in part of Iowan drift origin and in part included in the Mississippi loess area, the topographic features showing two main divisions corresponding to the two main regional soil divisions noted. The county is drained mostly by the Maquoketa River and its tributaries.

Carrington loam found in the drift soil group and covering a total of 22.9 per cent of the area surveyed is the most extensive of the 24 types, here classified into 16 series. Tama silt loam 14.9 per cent, Carrington silt loam 12.4, and Clinton silt loam 11.9 per cent follow in order of extent among types of major areal importance. Drift soils comprised 58.2 per cent of the entire area and loess soil 29.7 per cent, with small areas also of terrace, swamp and bottom land, and residual soils.

Jones County includes 364,160 acres of Iowan drift and Mississippi loess soils and has topographic features ranging from undulating or gently rolling to the strongly rolling and hilly. Drainage is provided principally by the Wapipinicon and Maquoketa Rivers and is generally good. The four groups of soils found, drift soils 38.1 per cent and loess soils 49.1 per cent with small sections of terrace and of swamp and bottom-land soils, include, according to the classification here presented, 16 series inclusive of 28 types, of which Clinton silt loam in the loess group, 34.5 per cent of the entire county area, is the most extensive, followed by Carrington silt loam of the drift group with 15.7 per cent and Tama silt loam of the loess group with 12.5 per cent.

Fremont County, with a total extent of 328,320 acres, lies in the Missouri loess soil area and has a generally rolling surface with flat terraces and bottom lands along the streams. The greater part of the county has an extensive drainage system provided by the Missouri River and its tributaries. The drift, loess, terrace, and swamp and bottom-land soil groups are represented with 6.8, 39.5, 12.1, and 41.6 per cent, respectively. The most extensive type of the 20 here mapped and described in 11 series is Marshall silt loam, a loess soil occupying 33.1 per cent of the entire area of the county. The bottom-land soil Wabash silt loam follows with 15.3 per cent.

Cherokee County is for the most part included in the Missouri loess soil area and has a total extent of 366,720 acres of generally smooth, gently rolling plain, with drainage ways mapped as reaching practically all parts of the county.

Marshall silt loam in the loess soil group, covering a total of 70.8 per cent of the entire area of the county, is the most important in areal extent of 23 types here assigned to 14 series, and grouped into 11.3 per cent of drift, 76.4 of loess, 2.3 of terrace, and 10 per cent of swamp and bottom-land soils.

In addition to soil survey data proper each report contains some description of the soil needs of the county in question as indicated by laboratory and field experimental work, results of greenhouse work and field fertility tests, and an appendix dealing with the State soil survey in general.

Causes and effects of soil heaving, M. M. McCool and G. J. Bouroucos (*Michigan Sta. Spec. Bul.* 192 (1929), pp. 11, figs. 8).—This is a brief, more or less popular discussion of experiments and studies at the station.

"The expansion of water as it freezes is not the complete explanation for the heaving of soils. Soil heaving is due to the formation of ice crystals when the soil moisture freezes, either at the surface or below the surface of the soil. During the formation of the ice crystals unfrozen water is drawn to them by capillary or film movement and they grow in size and push upward, thus causing a greater degree of heaving than would result from the freezing of the water carried in the surface layer of soil without this constant addition of capillary water drawn to the crystals during the process of formation."

With respect to the prevention of injury to crops from this cause, it is stated that "although winter injury of crops by heaving is not easily controlled, there are certain things that can be done in some years to prevent or in other years to considerably lessen the severity of the injury. These preventive measures are top-dressing the ground with such materials as straw or manure, planting crops at the proper time, fertilizing them well so that the plants will make a large and vigorous growth, and draining the land."

Leaching impervious soil, E. W. Knight (*U. S. Dept. Agr. Circ.* 69 (1929), pp. 29-32, fig. 1).—The soil in question is that of a rather flat area having a water table within from 3 to 4 ft. from the surface. Irrigation water failed

to penetrate in many places more than 6 in. The salt content was in most parts so high as to prevent the growth of alfalfa, and manure, gypsum, sulfur, and the application of sulfuric acid in the irrigation water, together with attempts to drain the area, all failed to produce any marked improvement. Further investigation of the condition showed the entire area to be underlain by alternate layers of sand and adobe, the last-named material coming in many places close to the surface.

Alum having been found in laboratory experiments capable of improving the permeability of refractory soils, an application was made on four of the worst places in the area of a low-grade alum-bearing ore, with the result that a fairly uniform stand of alfalfa was obtained, without, however, a satisfactory subsequent growth. A further improvement in drainage has since reduced the water table by an average of 1.4 ft., and improved leaching has reduced the salt content by an average of about 250 parts per million.

A table shows the marked improvement obtained in yields of alfalfa hay from 9 plats during the period 1923-1927.

Composting barnyard manure with sulphur and rock phosphate, W. G. FRIEDEMANN (*Georgia Sta. Bul. 154* (1929), pp. 14, figs. 5).—Sulfur-treated composts lost about 10 per cent of their total nitrogen. Untreated composts lost larger quantities of nitrogen. Manure not composted was less effective in securing immediate returns in the yield of sorghum plants than was the composted product.

Adding a mixture of 0.25 lb. of sulfur with 1.25 lbs. of rock phosphate per day per 1,000-lb. weight of animal to litter on the floor of stalls was found practically to prevent the loss of nitrogen from the manure and did not injure the feet of mules. No advantage was found in adding rock phosphate to manure without the addition of sulfur. Superphosphate (16 per cent) was better for preventing loss of nitrogen from liquid manures than was either sulfur or gypsum.

It is further asserted that "part of the phosphoric acid of manure-rock phosphate-sulfur composts became available (water- and citrate-soluble) during composting. More than 200 lbs. of sulfur alone applied per acre to the soil may lower the yields of corn and cotton on Cecil clay loams and lighter soils. When sulfur is added to manure at the rate of 20 lbs. per ton with 100 lbs. of raw rock phosphate and composted for 3 months or longer a desirable compost is obtained. In most cases, greater crop yields are obtained from the use of this compost than from untreated manure composts." Cottonseed meal and water added to dry straw hastened decomposition.

Artificial manure from straw, R. C. COLLISON and H. J. CONN (*New York State Sta. Bul. 573* (1929), pp. 17).—For some years the station has been studying methods of treating straw to overcome its injurious effect when added to the soil. Both a patented process for making artificial manure and the fertilizer mixture previously noted (E. S. R., 59, p. 22) were used. Both methods, in about three months, rotted the straw to a point where no injurious straw effect was noted on the growth of plants. The investigations indicated, however, that "the labor involved, the large water supply necessary, and the cost, made it questionable if the method would be practical under average farm conditions, at least in New York. Where the necessary requirements mentioned can be met, the method is worth a trial."

Cutting down labor and water supply by depending on natural rainfall was not successful in producing a good grade of artificial manure within a reasonable time. Piles made December 1 in the usual way except that the reagents were more carefully scattered, the piles more firmly compacted, and no water

added showed little rotting by May 1, although rainfall was considerable in December, snowfall abundant during the winter, and the early spring rains normal. Even at the end of a year much undecomposed straw was present.

The addition to similar composts of calcium chloride or of muck showed the former to be detrimental and the latter only slightly beneficial. It was found possible, however, "to overcome the harmful effects of the straw by composting under natural rainfall without anything present to absorb the moisture except the straw, provided a long enough period is employed"

Fertilizers, J. H. CHRIST (*Idaho Sta. Bul. 158 (1928)*, pp. 30, 31).—Most of the upland soils of the cut-over lands of northern Idaho are inadequately supplied with nitrogen, sulfur, and organic matter, legumes and manuring being recommended to supply the nitrogen deficiency and to help in the building up of the organic-matter content. Gypsum was found a practical form in which to supply the sulfur required, 200 lbs. to the acre being applied every three or four years and best in the fall or early spring.

Though most of the forest soils here dealt with show an acid reaction in the surface soil, "the subsoils often are well supplied with lime," and in comparative experiments the use of gypsum gave better results than did liming. A table shows the effect upon the yields of a number of crops of lime, gypsum, and phosphate and of no treatment.

General soil fertility test (*Indiana Sta. Circ. 164 (1929)*, pp. 2-6).—General fertilizer tests at the Moses Fell Annex Farm, at Bedford, Ind., for the most part of the usual sort, are reported with costs of treatments and profits obtained. "It will be noted, in comparing earlier reports [*E. S. R.*, 59, p. 615] and in examining the crops on the experiment field, that the spread between the good and poor treatments is becoming greater year by year and that the better treatments are becoming more and more profitable. Without soil treatment, the average value of the crops per rotation of corn, soybeans, wheat, and clover is now \$34.67. With lime, manure, and phosphate, the value is \$95.05, at an average cost of \$8.90 for lime and phosphate."

Fertility work, J. F. O'KELLY (*Mississippi Sta. Rpt. 1927*, pp. 13-15).—Tests of various "complete" formulas, made with a view to choice of the most profitable proportions and application rates and carried out in the usual way, are reported and discussed. The results, of local applicability, include the observation of an apparently close similarity among the soils used, indicating a need of nitrogen nearly equal to that for phosphate with an indeterminate potassium requirement and a rate, with cotton salable at the 1926 prices, of about 600 lbs. of a fertilizer of "approximately the correct analysis." A mixture of Ammophos and potassium nitrate was as efficient as one with nitrate of soda, superphosphate, and muriate of potash.

Testing soils for their lime need, M. F. MILLER and R. E. UELAND (*Missouri Sta. Bul. 272 (1929)*, pp. 15, 16, fig. 1).—Acidity requiring more than 4,000 lbs. of limestone to the acre for its correction was found in 44 per cent of the Missouri soils according to the stated result of the test used, and in 75 per cent of the Missouri soils the acidity was such as to demand over 2,000 lbs. of the limestone to the acre.

Choosing the right liming material, R. M. SALTER (*Ohio Sta. Spec. Circ. 24 (1929)*, pp. 4, fig. 1).—This is a popular discussion of such factors as fineness, neutralizing power, etc., in relation to cost. A table shows equivalent quantities of several liming materials, price of each delivered at Wooster, and rate of application (1) in the season before legume seeding and (2) at the time of legume seeding.

AGRICULTURAL BOTANY

Long time experiments with plants in closed containers, R. H. WALLACE (*Bul. Torrey Bot. Club*, 55 (1928), No. 6, pp. 305-314, pl. 1, fig. 1).—In experimentation described as carried out with 12 species of plants under conditions of isolation from ordinary air, *Oxalis stricta*, *Begonia semperflorens*, *Impatiens sultani*, and *Vinca rosea alba* became diseased and died within a few weeks after sealing. *Coleus blumei*, *Bryophyllum calycinum*, *Nicotiana tabacum*, and *Mimosa pudica* were kept alive for months when sealed hermetically, but with progressive deterioration. *Thuja occidentalis*, *Woodwardia orientalis*, *Dryopteris normalis*, and *Selaginella emiliana* proved very well adapted to life in closed containers. Details are given. Supposedly, the more or less balanced gas relation in photosynthesis and respiration is by no means the only factor determining the survival of the plants in closed containers, but it is clear that so far no green plant in such isolation has been brought to the point of production of viable seeds or spores to complete its normal life cycle. Further experimentation is planned.

The soil solution as a nutrient medium for plants, W. L. POWERS (*Jour. Amer. Soc. Agron.*, 19 (1927), No. 11, pp. 1012-1014, fig. 1).—It is stated that the first percolate from lysimeter tanks at the beginning of the rainy season at the Oregon Experiment Station proved to be similar in composition to the displaced soil solution from the same soil type and was used for growing barley seedlings in water cultures in the greenhouse. The average amount and composition of percolation from different untreated and treated lysimeters as found by Higby, in connection with this work, have been noted (*E. S. R.*, 58, p. 116). A preliminary study is indicated as made, in which the essential nutrients, in different combinations, were added to the lysimeter water.

The experiments indicate that the percolate from lysimeter tanks at the beginning of the rainy season furnishes a solution that approximates the composition of the soil solution in quantities sufficient for culture experiments. The importance of proper pairing of essential ions to physiological availability appears from these studies. It is thought that for barley plants the essential ions, especially nitrate and potassium, are of insufficient concentration or amount in the percolate or in the soil solution to support the best growth without replenishment, and that these ions are best taken up by the plant in association with each other. From similar studies, it appears that calcium is taken by the plant very well in association with sulfate, and that phosphate may be taken in association with magnesium. Evidence has been obtained that late in the growing period nitrate may advantageously be supplied in association with calcium.

The influence of oxygen on the effects of light in the germination of light-sensitive seeds [trans. title], G. WIESER (*Ztschr. Wiss. Biol., Abt. E, Planta, Arch. Wiss. Bot.*, 4 (1927), No. 4, pp. 526-572, figs. 9).—Accounts and results are detailed of studies employing separately *Lythrum salicaria* and *Nicotiana tabacum*, with comparisons. It appears that in general germination behavior, as well as in relations with oxygen, the seeds of *N. tabacum* and those of *L. salicaria* behaved much alike qualitatively, but somewhat differently quantitatively. Details and inferences are presented.

A study of the metabolism of roots (*Missouri Sta. Bul.* 272 (1929), p. 41).—In continuation of studies on excised roots (*E. S. R.*, 56, p. 125), W. J. Robbins found that the failure of excised roots to grow indefinitely when maintained under sterile conditions and supplied with glucose and mineral salts might be

due to one or more of the following causes: Toxicity of the mineral nutrient solution, failure of the roots to absorb glucose rapidly enough to supply growth requirements, lack of some essential mineral element, lack of an accessory food or a vitamin, and disturbance in the respiratory process.

Glutathione, a substance associated with respiration according to some investigators, was found to be present in cornroot tips. The effect of methylene blue and of traces of heavy metals on growth was investigated.

Periodical variations in chlorophyll content of evergreens [trans. title], M. G. STÄLFELT (*Ztschr. Wiss. Biol., Abt. E, Planta, Arch. Wiss. Bot.*, 4 (1927), No. 1-2, pp. 201-213, figs. 5).—These data, which are detailed chiefly from seasonal studies on *Pinus sylvestris* and *Picea excelsa* and which do not include the values month by month of temperature and light, show a lessening of chlorophyll in midwinter, and alterations which are detailed in the chloroplasts.

Physiology of organic acids in green plants.—IV, Oxalic acid [trans. title], K. WETZEL (*Ztschr. Wiss. Biol., Abt. E, Planta, Arch. Wiss. Bot.*, 4 (1927), No. 4, pp. 476-525, figs. 7).—In the course of work pursuant to that previously reported (E. S. R., 59, p. 426), the author deals herein with oxalic acid as regards its origin, history, and certain chemical relationships in the plant.

Production by *Aspergillus niger* of citric and of oxalic acid [trans. title], S. KOSTYTSCHEW and W. TSCHESNOKOV (*Ztschr. Wiss. Biol., Abt. E, Planta, Arch. Wiss. Bot.*, 4 (1927), No. 1-2, pp. 181-200).—The assumption that citric acid is normally a mediate product of respiration was not supported by the data from this experimentation. In the case of dilute sugar solutions no citric acid production could be noted, and even at the most favorable concentrations neither the formation nor utilization of citric acid could be detected.

Several facts seemed to indicate that citric acid is a residual product in the synthesis, regarding which particulars are detailed.

Relation of leaf acidity to vigor in wheat grown at different temperatures, A. M. HURD-KARREB (*Jour. Agr. Research* [U. S.], 39 (1929), No. 5, pp. 341-350, figs. 2).—In a previous publication the author reported that any growth condition that caused a decrease in the vegetative vigor of wheat plants resulted in an increase in the acidity of its juice (E. S. R., 51, p. 651). Further investigations were conducted to determine whether acidity might vary consistently with the type of growth and so reflect the degree of adaptability of a variety to a given environment.

The concentration of H ions in leaf juice of Hard Federation, Harvest Queen, and Turkey wheats grown at temperatures of from 12 to 18, 20 to 25, and 25 to 30° C., respectively, was found to be lowest at the low temperature and highest at the high temperature. The medium-temperature plants of all three varieties grew most rapidly at first, and almost without exception had the lowest titrable acidity, specific gravity, and dry-weight percentages throughout their vegetative stages, or as long as the temperature differences in the greenhouses could be maintained. The high-temperature plants generally had the highest titrable acidity, specific gravity, and dry-weight percentages. The magnitudes of the titrable-acid values were found to be closely correlated with those of the specific-gravity measurements at all three temperatures.

The pH value is said to have reflected the degree of adaptability of each variety to the different temperatures. Those plants which were best adapted, as shown by their vigorous growth and development, had pH values near 6.0 throughout the experiment. Those plants which were so injured that they failed to develop beyond the shooting stage had higher H-ion concentrations, extreme injury being accompanied by values near 5.6 while the plants were still in a vegetative stage.

The question of starch exhaustion in leaf wilting [trans. title], N. W. KISSELEW (*Ztschr. Wiss. Biol., Abt. E, Planta, Arch. Wiss. Bot.*, 4 (1927), No. 4, pp. 606-616).—Following up the wilting of leaves, a change of starch into sugar occurs in the leaf mesophyll. This becomes perceptible after 2 to 4 hours, and the amount increases considerably afterwards. This change is not perceptible in shaded leaves, supposedly on account of their lower starch content. In the stomatal guard cells this change was generally very slight.

A study of some factors affecting seed-stalk development in cabbage, J. C. MILLER (*New York Cornell Sta. Bul.* 488 (1929), pp. 46, figs. 20)—A report is given of experiments conducted to determine the effects of temperature, length of day, etherizing, and rest period in storage on seeding in mature cabbage plants, and the effects of temperature, length of day, size of plant, date of planting, checking growth, and the application of fertilizers on premature seeding in young cabbage plants.

When mature plants with solid heads were brought directly from the field into the warm greenhouse (60 to 70° F.), the high temperature was found to inhibit seed-stalk development, and the plants continued in a vegetative state for a period of 2½ years. Similar plants placed in a coolhouse (50 to 60°) developed seed stalks, but an average of 154 days was required for flower production. Five of the plants from the warm greenhouse were kept growing continuously for 1 year, and each produced three heads in succession.

Plants that had been given a 2 months' rest period in storage at an average temperature of 40° flowered in the warm greenhouse a month earlier than did those in the cool greenhouse. Plants that had the rest period produced flowers and seed in the cool greenhouse before those that were brought directly from the field and grown in the same house. Storage at 40° for from 15 to 30 days had little effect on seed-stalk development. After the plants had been in storage for 60 days, a high temperature materially hastened seed-stalk development.

The most effective method tried of hastening seeding was that of storing the mature plants for 2 months at about 40° and then growing them at temperatures averaging 70°. By this method seed was produced in less than 1 year from the time when the seed was sown.

Etherizing mature plants brought directly from the field did not hasten seed-stalk development. Increasing the length of day during the short days of fall and winter had little or no effect on seed-stalk development, either in mature cabbage or in young plants.

In the experiments with young cabbage, relatively low temperature during the early stage of growth was found to have a marked effect on seed-stalk development. There appeared to be a relation between the size of the plants when exposed to the relatively low temperature and the development of seed stalks. It is believed that the early sowing of the seed is important in premature seed-stalk development, primarily because of the size of the plants at the time when they are subjected to relatively low temperature.

The author claims that both heredity and environment are involved in premature seeding. Since most of the commercial strains of cabbage on the market are heterozygous, it is believed that they will behave differently under different environments. It is considered evident that the plants possess different genetic constitutions, and it is assumed that the number of seed stalks produced under conditions favorable for seeding will depend on the constitution of the plants.

The chemical data obtained from analyses of young plants are said to have shown no definite relation between the composition of the plants at the stages of growth when they were sampled and their subsequent behavior. With ma-

ture plants, there appeared to be a positive relation between the accumulation of elaborated foods in the meristematic region and seed-stalk development.

Influence of atmospheric and soil moisture upon seed setting in red clover. E. A. HOLLOWELL (*Jour. Agr. Research* [U. S.], 39 (1929), No. 4, pp. 229-247, figs. 5).—The results are given of a study made to determine whether high atmospheric humidity prevents fertilization and whether a deficiency or excess of soil moisture adversely affects the setting of seed in red clover.

Soil moisture, whether low, medium, or high, did not prevent the setting of red-clover seed either when plants were grown in the field or under controlled conditions. Medium soil-moisture content when compared with low or high soil-moisture content was found to increase the productiveness of red-clover plants with respect to both the number of heads and flower stems and vegetative growth. Plants grown in soil low in moisture produced a greater number of heads and more vegetative growth than those grown in soil high in moisture. Low soil moisture and high soil moisture were more conducive to early flowering and uniform maturity than a medium soil moisture. A greater number of florets per head were produced when plants were grown in soils of medium and low moisture content than when they were grown in soils of high moisture content. The differences in soil moisture were not found to affect the physical condition of the pollen.

Atmospheric humidity did not affect the setting of red-clover seed under greenhouse or field conditions. When the plants were growing under field conditions, cross-pollinated florets wet with meteoric water produced seed.

Effect of pericarp injury on moisture absorption, fungus attack, and vitality of corn. H. W. ALBEETS (*Jour. Amer. Soc. Agron.*, 19 (1927), No. 11, pp. 1021-1030, figs. 2).—Corn kernels which had been subjected to injury showed more moisture absorption in moist air than did uninjured kernels. Saprophytic fungi invaded the endosperm where the pericarp had been broken or removed. Under conditions of storage allowing but little change of atmospheric moisture, pericarp injury cause no reduction in viability. Injured as compared with uninjured kernels showed lessened weight, growth, and vitality in the seedlings after sprouting. Corn injured by bruising or gnawing by mice had little value for seedling purposes.

Influence of freezing of seed potatoes on viability and yield. R. C. WRIGHT, W. M. PEACOCK, and P. M. LOMBARD (*U. S. Dept. Agr., Tech. Bul.* 119 (1929), pp. 11, figs. 5).—In order to determine the possibility of using frozen potatoes for seed purposes, samples of several varieties of potatoes were frozen under controlled conditions and their value for planting determined.

Experiments covering three years showed that potatoes treated as described and showing considerable blackening or discoloration of the freshly cut tissue gave so poor a stand as to render them economically unfit for seed purposes, although the yield per hill was comparatively good. Tubers showing slight freezing, that is, injury caused by or accompanying the crystallization of water in the tubers, proved suitable for seed. An increase in vitality and yield was observed in certain potatoes that showed no indications of freezing injury after having been exposed to temperatures that caused marked injury to other tubers of the same lot. Whether this was due to the elimination of tubers of low vitality by freezing or to some stimulation of the growth processes was not determined.

From the results obtained it is considered probable that under certain conditions seed stock known to have been more or less frozen can be utilized if properly handled.

GENETICS

Cotton breeding studies, I, II, J. O. WARE (*Arkansas Sta. Bul. 243* (1929), pp. 38, figs. 4).—Studies of F_1 and F_2 progeny from crosses between (A) Pima (long) and Winesap (short), (B) Pima and Upright (short) and sea island (long) and (C) Winesap cotton showed long fiber dominant over short in the three sets of crosses. Dominance was practically complete in the A and C crosses, and length of fiber was intensified in the B crosses. Considerable factorial interaction was indicated, and there seemed to be several factors responsible for the determination of fiber length.

Okra Leaf cotton crossed with normal leaf plants showed, as in the work of others, a modified monohybrid mode of inheritance resembling that of red plant color (E. S. R., 58, p. 27). Okra Leaf green plants crossed with red normal leaf plants gave rise in F_1 to plants identical in color with F_1 of the monohybrid red plant-green plant cross, and in leaf shape identical with F_1 dihybrids of the monohybrid Okra Leaf-normal leaf cross. The F_2 segregated into nine types of which the F_3 , F_4 , and F_5 generation data revealed that red Okra Leaf, green Okra Leaf, red normal leaf, and green normal leaf plants are homozygous and breed true indefinitely; that all genotypes, homozygous for one pair of factors and heterozygous for the other pair, segregate in the next generation to a 1 : 2 : 1 ratio for the heterozygous character; and that the doubly heterozygous genotype segregates for both characters and splits into the nine visible groups. Intermediate leaf lobation and dilute red color as exhibited in these hybrids were both unstable characters and did not breed true as such.

Linkage was not observed between Okra Leaf and green or red color or between normal leaf and green or red color. The factors for Okra Leaf and for red plant color seem to lie in separate chromosomes. Since red is allelomorphous to green and Okra Leaf allelomorphous to normal leaf and no linkage has been established between either of the four characters, the factor of each character evidently exists in a respective chromosome, four chromosomes being involved in the plant color and leaf shape dihybrid.

Correlated inheritance in a wheat cross between Federation and a hybrid of Sevier \times Dicklow, G. STEWART and D. E. HERWOOD (*Jour. Agr. Research* [U. S.], 39 (1929), No. 5, pp. 367-392, figs. 9).—The inheritance and correlated inheritance of culm length, spike density, awn classes, and several other plant characters were studied into F_2 at the Utah Experiment Station in a cross between Federation (awnless) and III C-18 (fully awned), a productive strain selected from Sevier \times Dicklow. Mean values in the parent rows were, respectively, for Federation and III C-18: Length of longest culm to base of spike 75.34, 91.96 cm.; spike density (length of 1 rachis internode) 5.02, 2.62 mm.; awn length 5.05, 73.07 mm.; neck thickness 2.4, 2.34 mm.; and culms per plant 10.13 and 9.46. The glumes were, respectively, dark bronze and white in color.

Glume color in inheritance seemed to involve a one-factor difference, whereas a two-factor difference with independent segregation was apparent in regard to awn classes. Segregation was evident in culm length. The culm length range in parental rows was covered by the F_2 progenies. A one-factor difference, with perhaps some minor factors involved, appeared probable in the inheritance of spike density in the cross. The awn length range of the parental rows was recovered in the F_2 progenies. Neck thickness, and likewise number of culms, was essentially the same in parents and progenies. The spike density and awn class factors in the cross did not appear to be linked.

Although culm length did not seem to be correlated with spike density in either parent, or in either of the three spike density groups, when the correlation coefficient was calculated for the entire family of F_2 progenies there was a significant correlation, i. e., the factors for the spike density classes seemed to influence culm length distinctly. Culm length and awn length were correlated distinctly in the homozygous fully awned progenies, but the other homozygous awn class groups showed no correlation. The entire family showed no correlation, yet the correlation ratio and Blakeman's test indicated the presence of a correlation which was found in the fully awned group. Spike density and awn length also seemed to be correlated in one of the homozygous awn groups but not elsewhere. This correlation had also been indicated by the correlation ratio. Spike density and neck thickness were found to be correlated in the Federation parent, in the four homozygous awn groups studied, and in the entire family.

The possible modification of the response of the wild type to recurrent mutations, R. A. FISHER (*Amer. Nat.*, 62 (1928), No. 679, pp. 115-126).—From a theoretical consideration of mutations in *Drosophila melanogaster*, the author concludes that the majority of mutations which can be observed in cultures—representing only a small part of the wild population—must have occurred previously in the wild species with very great total frequency. Under experimental conditions rapid modification may result from the selection of factors capable of modifying viability, and it therefore appears that even low mutation rates are important in natural selection in case of the heterozygotes. It is further concluded that “the observed behavior of multiple allelomorphs largely supports, though that of specific modifiers seems to oppose, the view that complete dominance generally may be regarded as a product of such selective modification.”

Naked—a recessive mutation in the rabbit, D. A. KISLOVSKY (*Jour. Heredity*, 19 (1928), No. 10, pp. 438, 439, pl. 1, fig. 1).—In experimental breeding tests at the State Institute for Experimental Veterinary Medicine, at Koosminky, near Moscow, Russia, individual rabbits were produced which did not develop hair over the body, and some had defective teeth. The condition was attributed to a simple recessive genetic factor. Such individuals did not live beyond one month of age.

A periclinal tomato-potato chimaera, C. A. JØRGENSEN (*Hereditas*, 10 (1928), No. 3, pp. 293-302, figs. 7).—Ultimate objects, mediate plans, procedures, and results are indicated regarding experimentation giving, and growing during its persistence, a tomato-potato chimera.

A form in which the one-layered potato skin partly enveloped the main tomato interior is classed as a mericlinal form. This is contrasted with that distinguished as sectorial (each member reaching part way around but extending to the center of the stem), also with what is called the periclinal form, in which one member is wholly external but superficial. One of these is described in some detail.

During the autumn of 1926, the mericlinal tomato-potato chimera here discussed grew into a promising plant. Strong axial shoots developed, and an abortive inflorescence appeared. Later the plant began to look sickly. Removal of the top and of the strong side shoot and attempts to root these failed, both parts dying, as did also the remainder of the plant.

Facts are indicated as supposedly justifying the hope that crop plants, if they can be protected by a one-layered skin, or better by a two-layered skin of a related immune species or variety, may prove highly resistant to the diseases that ordinarily would endanger them.

Inheritance of color, beard, tassels, and horns in the goat, S. A. ASDELL and A. D. B. SMITH (*Jour. Heredity*, 19 (1928), No. 9, pp. 425-430, fig. 1).—From a study of the records in the Kid Register of the British Goat Society, five series of colors were designated. Black appeared to be the lowest term in the series black, chocolate, fawn, and cream. Brown was dominant to all colors in the black series, as well as to red and tan. The red and tan series was recessive to the colors of the black series. Gray and roan were dominant to the black and the red and tan series, but recessive to the brown. White was dominant to all colors.

From personal observation of specific matings it appeared that the beard characteristic was due to a factor dominant in males and recessive in females. A single dominant factor seemed to control tassels in most cases, but there was evidence of a more complicated mode of inheritance. The records of the Kid Register indicated that polled was due to a simple dominant factor.

Quintuplet lambs—an unusually large family, J. E. NORDBY (*Jour. Heredity*, 19 (1928), No. 9, p. 384, fig. 1).—The birth of five lambs to a single Rambouillet-Cotswold ewe, all of which were raised, three being reared on a bottle, is noted.

[Studies of the physiology of reproduction and milk secretion at the Missouri Station] (*Missouri Sta. Bul.* 272 (1929), pp. 46, 48-51, 55-56, figs. 6).—Brief accounts of the following investigations are noted.

Size and forms of spermatozoa of the bull, W. Gifford and C. W. Turner (p. 46).—Measurements of the length and width of the heads of over 700 spermatozoa have shown no indication of dimorphism in the distribution of the measurements, a single mode being observed.

Fetal development of the mammary gland in dairy cattle, C. W. Turner, E. C. Elting, and W. Gifford (pp. 48-51).—The development of the mammary gland and its anlage in embryos of cattle has been studied histologically, and the findings are briefly described and illustrated.

The anatomy of the cistern and duct systems in the mammary glands of dairy cattle, C. W. Turner, E. C. Elting, and W. Gifford (pp. 55, 56).—For the purpose of studying the anatomy and form of the cistern and ducts, five animals were injected with different fluids, including paraffin, plaster of Paris, celloidin dissolved in acetone, Wood's alloy, and equal parts of beeswax and resin. It was found that the last combination gave the best picture of the duct systems.

On ligature of the vas deferens in the cat and researches on the efferent ducts of the testis in cat, rat, and mouse, J. T. CUNNINGHAM (*Brit. Jour. Expt. Biol.*, 6 (1928), No. 1, pp. 12-25, pl. 1, fig. 1).—Ligature of the vas deferens in a cat caused the epididymis to become distended with semen at the time of post-mortem examination 104 days after the operation, but did not interfere with normal spermatogenesis. In rats, however, ligature of the vasa efferentia was followed by disorganization of the seminal epithelium and cessation of spermatogenesis. After ligature of the marginal epididymo-testicular membrane normal spermatogenesis usually continued. Anatomical differences between the cat and the rat are noted with reference to the epididymis and vasa.

A fertile mare mule, A. H. GROTH (*Jour. Heredity*, 19 (1928), No. 9, pp. 413-416, figs. 4).—An account is given of a mare mule at the Texas A. and M. College which was fertile when mated to a jack and a stallion. The stallion colt sired by the stallion has also sired at least one foal. Blood tests conducted by K. Landsteiner, of the Rockefeller Institute for Medical Research, showed that the blood of the fertile mule and her offspring by a jack reacted in accordance with that of mules, while the sample from a colt sired by a stallion behaved somewhat differently.

A new type of mammalian intersexuality, J. R. BAKER (*Brit. Jour. Expt. Biol.*, 6 (1928), No. 1, pp. 56-64, pl. 1, figs. 5).—The author describes the occurrence of intersexual pigs in certain of the New Hebrides Islands at the rate of 10 to 20 per 100 normals. The intersexes may be distinguished by the presence of tusks. Anatomically they may be divided into seven grades, depending on their resemblance to males or females. There was, however, a complete absence of any rudiment of a uterus or vagina, thus differing from other intersexes described in the pig. The intersex pigs are held at a premium locally because of their use for certain social functions. The intersex condition appears to be inherited as a sex-linked factor, intersexes being males obtaining the factor from their dams.

Studies on the relation of gonadic structure to plumage characterisation in the domestic fowl.—IV, Gonad cross-transplantation in Leghorn and Campine, A. W. GREENWOOD (*Roy. Soc. [London], Proc., Ser. B*, 103 (1928), No. B 722, pp. 73-81).—In continuing this series (E. S. R., 61, p. 630), implantation of testes from Campine chicks into four castrated Brown Leghorn males induced the development of the normal male plumage, but implantation of the testes from a Leghorn male into an aged castrated hen-feathered Campine male did not induce structural modification of the feathering toward that of the normal male (hen-feathered). It is concluded that hen-feathering of the male in the hen-feather breeds and cock-feathering in other breeds is not due to an endocrine difference between the two kinds of testes, the explanation for the exception being an insufficient amount of testicular tissue in the transplant.

Cause of hen-feathering in Campine and Bantam males, C. H. DANFORTH (*Soc. Expt. Biol. and Med. Proc.*, 26 (1928), No. 2, pp. 86, 87).—The feathers produced by the follicles in skin grafts from typical cock-feathered and hen-feathered breeds indicated that the seat of the type of feathering lies in a differential response of the follicles to the same endocrine stimulus.

The morphology of intermediate rumplessness in the fowl, W. LANDAUER (*Jour. Heredity*, 19 (1928), No. 10, pp. 453-467, figs. 4).—Anatomical study of 23 adult intermediate rumpless fowls at the Connecticut Storrs Experiment Station showed that this type formed a graded series from nearly normal to nearly rumpless. They were differentiated from the normal by the absence of one or two of the vertebrae in the synsacro-caudal region and all of the vertebrae forming the pygostyl except the last two, and from the rumpless by the presence of free caudal vertebrae. The degree of differentiation of the caudal vertebra varied and was related to sex, but the number of synsacro-caudal vertebrae was unrelated to sex. A comparison of the intermediate rumpless, the hereditary, and the accidental rumpless conditions indicates that excalations of vertebrae may take place in a segment of the vertebral column without affecting the appearance of the remaining vertebrae in the region.

FIELD CROPS

[Crop experiments at the Moses Fell Annex Farm, Bedford, Ind., H. J. REED and H. G. HALL (*Indiana Sta. Circ.* 164 (1929), pp. 1, 7, 8, 14-16, fig. 1).—Experimental activities reported on resembled those noted earlier (E. S. R., 59, p. 626; 61, p. 328) and included fertilizer tests with tobacco, pastures, and crops in rotation, and varietal tests with winter wheat, rye, and barley, corn, oats, and soybeans.

[Field crops experiments in Missouri, 1927-28], L. J. STADLER, R. T. KIRKPATRICK, C. A. HELM, B. M. KING, T. J. TALBERT, J. T. QUINN, and R. E.

UHLAND (*Missouri Sta. Bul.* 272 (1929), pp. 62-65, 72, 73, 86, figs. 2).—Further investigations (E. S. R., 58, p. 428) reported on included breeding work with corn, wheat, soybeans, and oats; variety tests with wheat, corn, oats, soybeans, cotton, and potatoes; a spacing test with cotton; and comparisons of corn and kafir in rotations variously fertilized.

The chromosome aberration resulting in mosaic endosperm in corn was greatly increased in frequency by X-ray treatments. As to the normal frequency of mutation of the *R*, *C*, *Pr*, *I*, *Y*, *Su*, *Sh*, and *Wx* genes for endosperm characters in corn apparent mutations of seven of the genes were found, whereas no mutations of *Wx* occurred in untreated plants among more than one million germ cells tested. An attempt to induce mutation by X-ray and radium treatment of barley (E. S. R., 60, p. 127) was successful.

Study of weather records and yields of corn from station plats indicated that no one factor determined the return from fertilizers. The more important factors were the amount of rainfall, distribution of rainfall, high summer temperature, time of planting, and spring conditions of the crop. Seasons particularly favorable for high yields did not always give maximum returns from fertilizers. All plats at the station averaged 52.9 bu. The average increase from fertilizer treatments was only 4.6 bu. as compared with an average increase of 10.7 bu. for the last 4 years. Nitrogenous fertilizer as a side dressing for corn at the second cultivation produced good results on outlying fields.

Northern-grown certified seed potatoes gave better results than the spring home-grown or the northern uncertified stock. Seed from fall home-grown Irish Cobbler and Early Ohio equaled northern-grown certified seed in total yield but grew a higher percentage of culls. Fall home-grown seed of Irish Cobbler 1 year from northern certified stock outyielded fall home-grown seed grown in Missouri for several years. The highest yield was made on Putnam silt loam with a 3-12-4 fertilizer at the rate of 400 lbs. per acre plus 8 tons of barnyard manure plowed under the previous fall.

In seed treatment experiments an organic mercury compound gave control for scab and *Rhizoctonia* equal to either the corrosive sublimate or hot formaldehyde treatments. Potassium permanganate and Bordeaux gave satisfactory results as potato seed disinfectants. None of the different methods of mixing Bordeaux spray for use on potato plants resulted in burning.

Roots of sweetclover were all dug April 26, 1928, from plants harvested at different dates the previous fall. There was a very large growth in roots, characteristic of sweetclover, in the month between October 7 and November 9, there being a rapid transfer of food materials from stem to roots during this period. It is pointed out that sweetclover harvested in September or early October will not make much root growth in the fall and often will sustain a high percentage of winterkilling, whereas that harvested a month or six weeks later will have a large root growth and much less winterkilling.

[Field crops investigations in Mississippi, 1927], J. F. O'KELLY, C. F. BRISCOE, J. C. C. PRICE, C. T. AMES, E. B. FERRIS, and H. F. WALLACE (*Mississippi Sta. Rpt.* 1927, pp. 9-13, 21, 22, 34, 40, 41, 42-45, 56, 58, 59, 60, 61).—Agronomic activities (E. S. R., 58, p. 31) reported on from the station and substations included breeding work and variety tests with cotton, corn, oats, and soybeans; trials of silage crops, winter legumes, sweetpotato varieties, and certified seed potatoes; cultural (including planting) tests with corn, cotton, sweetpotatoes, and soybeans; fertilizer tests with cotton and corn; inoculation studies with soybeans; and crop rotations. The work at the several substations has been reported in detail from other sources.

[Crop experiments on the Newlands, Nev., Field Station, 1924-1927], E. W. KNIGHT (*U. S. Dept. Agr. Circ. 69 (1929), pp. 11-18*).—Further experiments (E. S. R., 53, p. 834) reported on briefly for the years indicated included variety tests of potatoes and corn, fertilizer tests with corn and wheat, and trials of methods of cropping for marginal lands.

Crop production at the Tucumcari Field Station, D. R. BURNHAM and H. J. CLEMMER (*New Mexico Sta. Bul. 176 (1929), pp. 42, figs. 10*).—Experiments in the production of field crops under dry land conditions, in cooperation with the U. S. Department of Agriculture, are reported on for the period 1921-1928, supplementing earlier work (E. S. R., 47, p. 333). The studies largely dealt with tillage methods and rotations and cultural and variety tests with grain and forage sorghums, corn, cotton, broomcorn, and cowpeas and other legumes. Environmental conditions and ways to control soil blowing are also commented on.

Crops on fall plowed land well supplied with moisture in the fall usually have surpassed those on spring plowing. However, when the soil is dry in the fall, spring plowing is advised instead. Fallow has not paid in comparison with the better adapted crop rotations, nor were subsoiling or deep tillage profitable. The better listing methods compared favorably with plowing when the cost of tillage is considered. Crops for green manure were unprofitable.

Dwarf varieties of grain sorghums and broomcorn were found to be better adapted than standard types. The choice varieties included Dwarf Yellow milo for grain, Sunrise kafir for bundle feed, Sumac sorgo for forage, and Scarborough broomcorn. The cultural tests indicate that sorghum in rows may endure dry seasons better than broadcast seedings. From May 15 to June 20 usually has been the best time for planting grain sorghums, and also cowpeas and beans. Broomcorn, however, produced less salable brush from early June seedings than when sown in early May or late June. Good spacings within the row were 6 in. for broomcorn, 6 to 12 in. for kafir, and 18 in. for Dwarf milo.

Cowpeas have produced hay of high quality and pinto beans made fair yields, both being beneficial to succeeding crops. Soybeans yielded less than cowpeas and were often damaged by rabbits. Sweetclover has given variable results in cultural tests, and from its varied behavior cotton is yet classed as hazardous.

[Field crops work at the Porto Rico Insular Station], F. A. LÓPEZ DOMÍNGUEZ (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt. 1927, Eng. ed., pp. 20-29, 30, 31, 33, 34, 35*).—Further investigations (E. S. R., 58, p. 31) included comparisons of varieties, seedlings and introductions, breeding work, fertilizer trials, soil fertility practices, cutting tests, and trials of methods of sampling, all with sugarcane, and variety trials with forage grasses, beans, and cowpeas.

The inoculation of non-legumes, L. W. EEDMAN and P. E. BROWN (*Iowa Sta. Bul. 262 (1929), pp. 317-339, figs. 15; abridged ed. (1929), pp. 8, figs. 5*).—Bacteriological studies revealed that Soilvita, a commercial culture for the inoculation of different crops, does not contain any large numbers of efficient ammonifying, nitrifying, or nitrogen-fixing bacteria and does not stimulate the processes occasioned by these organisms in Carrington loam, a normal Iowa soil. Greenhouse tests failed to demonstrate that Soilvita has a beneficial effect on corn, soybeans, wheat, oats, potatoes, or tomatoes. Evidence of a slight beneficial influence on the yield of barley, radishes, and pea hay was held inconclusive. It did not affect root development in corn, wheat, or oats. In field tests the use of Soilvita did not affect the yields of corn on three soil types nor the yield of soybeans.

Winter cover crop experiments, T. S. BUTE (*South Carolina Sta. Circ. 37* (1929), pp. 14, figs. 5).—Trials of cover crops during several winters at Clemson College, together with observations and experience, indicated that Austrian Winter field pea (*E. S. R.*, 60, p. 732), crimson clover, and hairy vetch are the best winter legumes for general planting in South Carolina. The winter field pea and clover made the greatest growth by April 23 (1928), and the vetch apparently the most dry matter by May 14. The winter field pea, although having a lower nitrogen percentage than any vetch tested, produced more dry matter by February 12 (1927), and a considerably greater quantity of nitrogen per acre. Early planting appeared to be necessary for successful growth of winter legumes. Stands of the winter field pea, hairy and Hungarian vetch, rye, barley, and wheat were not damaged by temperature lower than 10° F. The highest average yields of corn, both with and without a side application of nitrogen, were made following the Austrian Winter field pea.

Experiments with alfalfa, M. NELSON (*Arkansas Sta. Bul. 242* (1929), pp. 35, figs. 4).—Investigations with alfalfa (*E. S. R.*, 60, p. 813) variously involved varieties, maintenance and duration of stands, fertilizers and other treatments, the soil, and weeds.

The strain ranking on the basis of yield was Utah, Kansas, South Dakota, Argentine, Grimm (all strains), Dakota, Texas, Smooth Peruvian, Baltic, Oklahoma, and Hairy Peruvian alfalfa. The highest and lowest average annual yields differed by 0.78 ton. In relative hardiness the ranking of strains was Grimm (average all strains), Baltic, Dakota, Utah, Argentine, Kansas, Oklahoma, Texas, and Peruvian alfalfa.

Cultivation after crops were removed destroyed weeds effectively, but without definite marked results. Weeds starting in cold weather, threatening alfalfa during the first season's growth, were eradicated by mowing. Weeds as a rule did not take over the soil until stands of alfalfa had dwindled. Manure helped to increase yields and was moderately effective in maintaining stands, although it introduced weed seed. Superphosphate and potash were negligible in effects on yields and stands. Cutting in advanced stages was the most effective method used for maintaining stands, although annual and total yields were reduced materially thereby. Early and frequent cutting resulted in much better average annual returns, but stands did not hold up as well. Wide fluctuations of temperatures in winter seemed to injure alfalfa but not as a rule to kill outright.

The experiments made it plain that loss of stands of alfalfa tends to become more serious. Neither variety nor methods of treatment thus far employed have more than partially met this serious problem. In addition to supplying the general needs of alfalfa, the choice of a hardy variety, the liberal use of manure, and cutting in advanced stages of development are considered the best methods for prolonging the duration of stands.

High yielding strains and varieties of corn for Iowa, H. D. HUGHES, J. L. ROBINSON, and A. A. BRYAN (*Iowa Sta. Bul. 265* (1929), pp. 80, figs. 30; *abridged ed.* (1929), pp. 24, figs. 14).—Results in the Iowa corn yield test, with the cooperation noted earlier (*E. S. R.*, 59, p. 226) are reported for the years 1920-1927, inclusive. The strains entered by corn growers and breeders were compared in testing fields located in each of the western, central, and eastern districts of the northern, north-central, south-central, and southern sections of the State, or 12 in all. No effort was made to compare recognized varieties, since it has been found that different strains of the same variety may vary in yielding ability as much as distinctly different varieties. The planting of 3-row plats replicated 10 times has been the regular procedure since 1924.

Planting tests showed as optimum for northern Iowa 4 kernels per hill, particularly when the crop is harvested with machinery or livestock. In central Iowa from 3 to 4 kernels yield best and in southern Iowa 3 kernels. Seed corn high in germination usually will give from 75 to 85 per cent as many plants as kernels planted. Heredity, in general, seemed to be a factor somewhat more important than adaptation to a particular soil or locality. It was observed that in Iowa a satisfactory yield may be expected from an average sample of corn when grown either east or west of its point of origin.

In these yield tests the open-pollinated strains with the highest shelling percentages tended to be the highest yielding. Consideration of the moisture content at harvest and the yield of dry shelled corn by different strains on the same soil under uniform climatic conditions revealed that the high yielding strains in nearly every case are the earlier maturing strains. Nearly all of the hybrids of unusual value were produced by crossing strains of corn self-fertilized for several generations, usually six or more. In mean yield the hybrids surpassed the open-pollinated strains in 11 of 12 districts during each of 1926 and 1927 in which such comparison was possible.

Outstanding corns in the tests were Golden King, Smith Yellow Dent, and the Gronna strain of Silver King in northern Iowa, Osterland Yellow Dent in the north-central section, Steen Yellow Dent in the south-central section, and Walden Dent in the southern section. Rigid germination tests and the ear-row method of breeding continued for a few years, followed by careful mass selection, have been utilized by most of the breeders responsible for the high-yielding strains. In a survey of sorts of corn planted in Iowa in 1928 approximately 10 per cent of the total State acreage was planted with high-yielding strains located through the Iowa corn yield test, resulting in an increase in total production estimated to be not less than 1,250,000 bu. The survey indicated also that Reid Yellow Dent and Silver King are grown more generally in Iowa than any other variety.

The mean and variability as affected by continuous selection for composition in corn, F. L. WINTER (*Jour. Agr. Research* [U. S.], 39 (1929), No. 6, pp. 451-476, figs. 15).—The effect of 28 years of continuous selection for composition in corn upon the mean and variability of the selected character was studied at the Illinois Experiment Station (E. S. R., 60, p. 222).

Continuous selection for protein and oil content has produced four types of corn differing distinctly in their composition. Compared with the original non-selected material, high protein and high oil strains showed a proportional increase of 50 and 100.8 per cent, respectively, whereas the low protein and low oil strains exhibited a proportional decrease of 23.3 and 67.9 per cent, respectively. The high protein and high oil strains gave no indications of having reached a limit to further increases. On the other hand, the low protein strain has changed little during the last 20 years, and the low oil strain is approaching a physiological limit to further decreases. Ears extremely low in oil have had a high percentage of germless seeds. In their pedigrees the four different strains now trace back to a single ear each.

Variability was found to change considerably following selection, the degree of change depending somewhat upon the method of measuring it. The variability of oil or protein content appeared to depend upon the magnitude of the mean of the selected character. As measured by the coefficient of variation, variability increased when selection led to a low mean, and vice versa. However, variability, as measured by the standard deviation, Weinberg's formula, and extramodel coefficient, increased when selection led to a high mean and vice versa. The percentage of the population lying in the modal classes seemed

to decrease when selection led to a high mean, and vice versa the reverse also held true. The symmetry of the distribution curve, as determined by the percentile method, for the four strains taken at periodic intervals did not differ significantly from that of the normal variability coefficient. The presence of more material for the environment to interact with is suggested as a possible cause of the apparent increase in variability of the high strains.

Better seed corn, R. J. GARBER and M. M. HOOVER (*West Virginia Sta. Circ. 51* (1929), pp. 15, figs. 9).—This popular account of methods for improving corn gives instructions on the selection, preservation, and testing of seed.

Cotton fiber studies, R. C. CAMPBELL (*Georgia Sta. Bul. 158* (1929), pp. 15, figs. 6).—Technological studies on cotton fibers revealed for the varieties tested that increase in weight per inch of a cottonseed hair is accompanied by increase in tensile strength. In general mature and well-developed cottonseed hairs were stronger than immature, thin-walled hairs, supporting the view that the presence of a considerable percentage of immature fibers in a sample of lint will lower the tensile strength of the fiber, and to some extent, that of the yarn. However, it seemed probable that the strength of the yarn will probably be affected very little, if any, by the presence of immature hairs, since the same size of yarn would contain more hairs per cross section with a higher percentage of immature hairs.

Weight of hair per unit length increased with the progress of maturity from fertilization until opening of bolls. The increase during the first four weeks appeared due almost entirely to elongation of cells. During the rest of the maturation period the addition in weight came almost wholly from secondary thickening of the cell wall, such thickening being responsible for about two-thirds of the weight of ripe hairs.

The hair did not elongate very much, if at all, after about the thirtieth to thirty-second day of maturation. For varieties with bolls ripening in from 47 to 50 days after the blossom opens the maximum length is attained around the thirtieth day. Varieties with a maturation period of from 54 to 58 days require proportionately longer for hair elongation.

Short seed hairs were determined to be heavier in proportion to their length than long ones, indicating that ordinarily long staple cottons have a finer lint than short staple.

The production of Johnson grass for hay and pasturage, H. N. VINALL and M. A. CROSBY (*U. S. Dept. Agr., Farmers' Bul. 1597* (1929), pp. II+26, figs. 8).—This is a revision of and supersedes Farmers' Bulletin 1476 (E. S. R., 55, p. 134).

Spring-sown red oats, T. R. STANTON and F. A. COFFMAN (*U. S. Dept. Agr., Farmers' Bul. 1583* (1929), pp. II+18, figs. 12).—Superseding in part Farmers' Bulletin 892 entitled Spring Oat Production (E. S. R., 38, p. 340), information is given on the importance and distribution and on the climatic, soil, fertility, rotation, cultural, and harvesting requirements of spring-sown red oats. The three rather definite groups of red oats varieties, Red Rustproof and related strains, Fulghum and related strains, and Burt, are described briefly.

Potatoes, J. BUSHNELL (*Ohio Sta. Spec. Circ. 23* (1929), pp. 22-25, figs. 3).—Further experiments with potatoes (E. S. R., 60, p. 735) showed Irish Cobbler to lead early varieties and Russet Rural the late potatoes. When an original certified seed with a very low percentage of degeneration disease was planted late and some distance from any diseased potatoes and stored properly, excellent home-grown seed potatoes could be grown. Immature seed has given more vigorous sprouts, although slower growing, and usually has outyielded mature seed. In a 2-year rotation of potatoes and soybeans limed at different rates,

with the soybeans plowed under while green, the soil reaction ranged from pH 5 to 7.5. and the highest potato yield came from a plat with about pH 6. Scab was not serious.

Straw mulch has not given consistent nor large returns with late potatoes at the station. On early potatoes at the Hamilton County farm, mulching immediately after planting was detrimental, but by delaying the mulch until the plants were up and the soil warm the yield rose from 135 bu. per acre with cultivation to 166 bu. on the mulched plat. The cost of the straw and the labor involved in removal prohibit mulching as a general practice.

Studies on the character of sprouting in relation to time of planting (E. S. R., 61, p. 32) and on size of sets (E. S. R., 61, p. 433) have been noted earlier.

Concentrated fertilizers for potatoes in Aroostook County, B. E. BROWN and F. V. OWEN (*Maine Sta. Bul. 350 (1929), pp. 44, figs. 7*).—The comparative value of concentrated fertilizers and ordinary high-grade fertilizers for potatoes was studied in Aroostook County from 1925–1928 in cooperation with the U. S. D. A. Office of Soil Fertility Investigations. The mixtures as a rule ranged from double to treble concentrations, equivalent quantities of nutrients were applied, and either Irish Cobbler or Green Mountain potatoes were used, mostly on typical Caribou loam.

The uniformly good results obtained with concentrated fertilizers when compared with fertilizers of ordinary strength seemed largely due to the soil type and to ample, well-distributed rainfall. The use of such fertilizers under Aroostook County conditions appeared to be well justified, provided the mixture has a good physical condition so that it can be drilled uniformly and be well mixed with the soil before the potato sets are planted. Difficulty experienced at first in distributing certain experimental mixtures uniformly was due to poor physical condition caused by some of the readily deliquescent salts. Other studies showed that this trouble could be overcome by the inclusion of a relatively small proportion of cottonseed meal or other organic material for a conditioner. However, omission of deliquescent salts or their reduction to a harmless percentage may be preferable to addition of organic material for this purpose. No organic conditioner was needed when certain salts, as potassium nitrate, ammonium chloride, and ammonium phosphate, were used.

In large-scale tests concentrated fertilizers were applied fairly well with the fertilizer attachment of the potato planter, particularly concentrated fertilizers (10–16–14) at the rate of 1,000 lbs. per acre, equivalent to 2,000 lbs. of ordinary strength (5–8–7) fertilizer. Considerably more care was required to apply a 15–24–21 fertilizer uniformly with the planter. Certain changes in some of the fertilizer distributors now in common use may be required in order to apply the more highly concentrated mixtures as uniformly and as satisfactorily as one of less concentration, e. g., the 10–16–14.

Appended information deals with the characteristics of fertilizer materials and the soil type, statistics of potato production, fertilizers, and prices, meteorological data, and the arrangement of plats.

Reed canary grass, H. A. SCHOTH (*U. S. Dept. Agr., Farmers' Bul. 1602 (1929), pp. II+10, figs. 5*).—The origin and history, characteristics, adaptation, and soil and cultural requirements are outlined for reed canary grass (*Phalaris arundinacea*). Information is also included on its worth for pasture, hay, silage and soiling, methods of haymaking, chemical composition, and seed production.

Native to the northern half of the United States, reed canary grass is grown extensively only in the coastal sections of Washington, Oregon, and northern California, although it is deemed deserving of wider use in the northeastern

States. It does best where the climate is moist and cool and is suited especially to swampy or overflowed lands. The grass is excellent for hay and pasture, is succulent and palatable, and provides a long grazing season and large hay yields.

Results of tobacco experiments in Pennsylvania 1922 to 1927, O. OLSON and D. E. HALEY (*Pennsylvania Sta. Bul.* 240 (1929), pp. 22, figs. 8).—Tobacco investigations from 1922 to 1927, reviewed as in an account for the period 1912–1922 (E. S. R., 49, p. 737) and with similar cooperation, included fertilizer experiments, breeding and strain tests, trials of paper mulch, attempts to lower the nicotine content of cigar-leaf tobacco, production of tobacco with high nicotine content, curing and fermentation experiments, and chemical investigations in relation to burning qualities. The results of most of the experiments have been noted extensively from other sources (E. S. R., 50, p. 437; 52, pp. 252, 535; 53, p. 753; 54, pp. 328, 656; 58, p. 324; 59, p. 831; 60, p. 327).

Strains of cigar-leaf tobacco which were developed exhibited high resistance to root rot and produced a high yield under favorable environmental conditions. In the development of both high and low nicotine strains promising results have been obtained. The use of artificial heat has resulted in the prevention of pole burn and shorter periods of curing and of fermentation and appeared to prevent the development of black rot during fermentation. Plants grown with manure alone were consistently inferior in yield and quality to plants produced by manure supplemented with commercial fertilizers. High yields of good quality tobacco resulted from treatment with commercial fertilizers without manure. Chemical studies and burning tests showed that the composition of tobacco leaves may be affected materially by locality, weather conditions, and fertilizer treatment, and that, in turn, the chemical composition affects their burning quality.

Varieties of hard red winter wheat, J. A. CLARK and K. S. QUISENBERRY (*U. S. Dept. Agr., Farmers' Bul.* 1585 (1929), pp. 11+13, figs. 4).—This is a revision of and supersedes Farmers' Bulletin 1280 (E. S. R., 48, p. 231).

Results of wheat variety tests at the Piedmont Branch Station Farm, 1923–1929, G. M. GARREN (*North Carolina Sta. Agron. Inform. Circ.* 30 (1929), pp. 3).—Fulcaster and its strain Stoner and its selection Nittany have made high average yields over 5- to 7-year periods during the years indicated. Gleason, a smooth wheat, ranked next to Fulcaster over 7 years.

Higher quality wheat: Why and how (*Ohio Sta. Spec. Circ.* 25 (1929), pp. 12, fig. 1).—A practical discussion of the market demands for uniformity in wheat premiums and discounts due to quality and factors determining grades. Suggested means for producing high quality wheat include the use of improved varieties, pure seed, treatment of seed for smut, increase of test weight through cultural and fertilizer practice, and proper care in harvest, threshing, and storage.

Canada thistle and Russian knapweed and their control, C. F. ROGERS (*Colorado Sta. Bul.* 348 (1928), pp. 44, figs. 11).—The characteristics, growth, habits, distribution, root system, and noxious qualities are described in some detail for Canada thistle and Russian knapweed. Methods are also suggested for the prevention, control, and eradication of such perennial weeds.

Eradicating the bindweed with sodium chlorate, E. G. SCHAFER, O. C. LEE, and J. R. NELLER (*Washington Col. Sta. Bul.* 235 (1929), pp. 16, figs. 4).—Results obtained on plats infested with bindweed (E. S. R., 57, p. 633) and sprayed with several quantities of different strength solutions of sodium chlorate, application on some plats being repeated, led to the suggestion that 3 lbs. of sodium chlorate in 3 gal. of water would treat adequately 1 square rod of infested land.

A second treatment might be needed on plants appearing the next year. Spraying may be effective at various times from midsummer until late fall. Wheat seeded on bindweed infested areas soon after treatment was injured greatly, although later plantings were not affected so badly. That sodium chlorate may be less effective in the presence of large quantities of vegetation, either bindweed or other plants, was evident from its reduced effect on the bindweed roots and lessened injury to the following crop. Sodium chlorate also seemed effective in destroying Canada thistle.

Methods and precautions for the use of sodium chlorate are outlined, and the merits of other chlorates and other chemicals are discussed from tests at the station.

Wild garlic and its control, M. W. TALBOT (*U. S. Dept. Agr. Leaflet 48* (1929), pp. 5, fig. 1).—The characteristics of wild garlic (*Allium vineale*) are described, and methods are outlined for the control of the weed on cultivated land, in pastures, and on small areas.

HORTICULTURE

Horticultural work [at the Moses Fell Annex Farm, Bedford, Ind.], H. J. REED and H. G. HALL (*Indiana Sta. Circ. 164* (1929), pp. 9–13).—Variety tests continued with peaches (E. S. R., 59, p. 633) showed Hale, Salway, and Shipper Big Red to be unprofitable, and they were therefore replaced. Additional insulation applied to the experimental storage plant, aided by a cool period in September, caused a marked reduction in the storage costs per bushel of apples and at the same time rendered the difference between the ventilated and iced storage rooms less notable. On December 13, 1928, the percentages of unsalable Grimes and Jonathan apples were, respectively, 7.1 and 4.5 in the ventilated room and 2.4 and 1.2 in the iced room. Tabulation is given of temperatures and storage costs during three years. The costs per bushel on a 1,200-bu. basis for storage in the iced chamber were 23.5, 26.9, and 18 cts., respectively.

[**Horticultural investigations at the Mississippi Station**], J. C. C. PRICE, W. S. ANDERSON, E. B. FERRIS, and H. F. WALLACE (*Mississippi Sta. Rpt. 1927*, pp. 32–34, 54–56, 57, 59, 60, 61).—Continuing activities (E. S. R., 58, p. 36), tomato breeding yielded some highly promising F_1 seedlings which are being carefully selected to obtain varieties free from cracking and greenness at the stem end. In studies with the blueberry it was found that root cuttings of pencil size were most satisfactory, giving 86 per cent of success. Cuttings of branches gave variable results in that practically all started growth but some died after producing short shoots or at transplanting. Old wood with a growing point of new wood appeared most satisfactory. The results of varietal tests with apples, pears, peaches, grapes, small fruits, and vegetables are discussed.

At the South Mississippi Substation varietal tests were made of various fruits. Satsuma oranges withstood a winter temperature of 14.5° F. with only a loss of part of their leaves, while round oranges and grapefruits were killed back to the soil. Northern blueberries from Whitesbog, N. J., failed to show adaptability. European grapes on American roots met with poor success, only 1 of 16 combinations showing vigor. Two species of pears obtained from the Southern Oregon Substation at Talent failed to propagate readily by cuttings. Of three methods of culture, continuous clean, alternating clean, and permanent sod, tried on peaches, clean culture gave the best results. Similar experiments with the Celeste fig showed too little growth in

sod and excessive growth under clean tillage. Comparing spraying and dusting on peaches and grapes, no differences were obtained with the peach, but spraying was more effective in the case of the grape.

At the Raymond Substation the Gulf States Market tomato was the heaviest yielder of eight varieties, with Marglobe outstanding in respect to wilt resistance. Of various forms of nitrogen used on tomatoes a 3-year average favored urea. It was found that at least a 3 per cent content of potash in the fertilizer was essential. For garden peas and snap beans 1,000 lbs. of a 10-3-3 (P-N-K) fertilizer was most effective, with sulfate of ammonia the most valuable source of nitrogen. For fruit trees, grapes, and raspberries an 8-4-4 mixture gave best results.

[Horticultural investigations at the Missouri Station] (*Missouri Sta. Bul.* 272 (1929), pp. 69-72, 73-76, pls. 2).—This is the usual report (E. S. R., 58, p. 436).

Studies by H. D. Hooker showed that fall applications of nitrogen fertilizers did not decrease hardiness. Injury and death from low temperature was found to occur before all moisture had been removed from the cell, suggesting no correlation with moisture content. Death from low temperature appeared to be determined by the rate of water loss and not solely by the amount of water retained. As determined by Hooker and H. G. Swartwout with girdled and ungirdled shoots of fertilized and unfertilized apple trees, there was a marked upward movement of fat during spring correlated with the movement of nitrogen.

Additional crosses were made by A. E. Murneek in the project upon breeding apples for late blooming, and determinations were made of the cold resistance of various peaches obtained for breeding purposes. As recorded by T. J. Talbert and Murneek, almost all of the varieties of filberts in the test plantings made good growth and showed hardiness.

In a strain test of cantaloupes conducted by J. T. Quinn no differences were noted in plants the seed of which was obtained from Florida, California, Colorado, and Missouri. Fertilizing cantaloupes in the hill gave the largest yields, and fertilized plants continued producing longer than did unfertilized. Clay pot and veneer band grown plants produced more early but less total yields. Strains of cabbage selected for resistance to yellows disease gave good results on infected soil, while nonresistant varieties showed as high as 96 per cent of infection. Texas-grown plants of the Crystal White Wax, Yellow Bermuda, and Red Bermuda onions gave higher yields and less split bulbs than did greenhouse-grown stock. The Yellow Bermuda onion responded better to fertilizer than did the other two. Tests of wilt-resistant tomatoes, such as Marglobe and Norton, gave favorable results.

As determined by Murneek, cross-pollination increased the set of fruit in Yellow Transparent, Wealthy, Gano, Maiden Blush, Ben Davis, Duchess, Jonathan, Grimes, King David, Rome, Winesap, Stayman Winesap, York, and Delicious. Delicious, Jonathan, Ben Davis, and Gano proved effective pollinizers for most varieties, but Winesap pollen was valueless. Unemasculated blossoms when crossed set more fruit than did emasculated blossoms. Murneek reports that in the apple (1) the reproductive organs, especially the fruits, dominate the metabolism of the bearing spurs, (2) flowering is characterized by a marked increase in all active forms of carbohydrates and nitrogen, which are translocated at this stage, (3) the rapid increase of sugars at full bloom results from hydrolysis of starch and hemicellulose, (4) large amounts of nitrogenous substances are moved into the bearing spurs during fruit fertilizing and setting, (5) both carbohydrates and nitrogen are absorbed from the drop-

ping blossoms preparatory to their abscission, (6) the development of leaves and fruit is characterized by an accumulation of water-insoluble nitrogen, and (7) young fruits showed a relatively high nitrogen concentration and older fruits more sugar, starch, and hemicellulose. The average number of leaves per fruit in heavily bearing Benoni, Jonathan, King David, Ben Davis, and Delicious trees was, respectively, 9.15, 13.95, 17.73, 12.28, and 16.42, indicating the need of thinning to produce good sized apples.

Talbert, Hooker, and Swartwout testing various sprays found that magnesium arsenate defoliated peach trees but that lead arsenate caused little injury. Magnesium arsenate was only slightly injurious to apples in general and controlled codling moth and curculio as well as did lead. Jonathan and Ingram apples suffered considerable burning from magnesium arsenate. One per cent oil emulsion did not cause material injury to apples when added to the regular summer spray, except at the calyx spray. One per cent oil gave good results as a spreader and seemed as effective as nicotine in controlling grape leafhopper, helped hold San José scale in check, and made codling moth control easier. Bordeaux mixture made directly in the tank with the agitators running caused no more injury than did that prepared by the customary method. A stock solution of Bordeaux mixture was used 24 and 48 hours after preparation without causing increased injury.

[Horticultural work at the Newlands, Nev., Field Station, 1924-1927], E. W. KNIGHT (*U. S. Dept. Agr. Circ. 69 (1929), pp. 18-21*).—The results of varietal tests (E. S. R., 53, p. 840) with tomatoes, onions, cucumbers, and cabbages are presented, with discussion.

[Horticultural work at the Ohio Station] (*Ohio Sta. Spec. Circ. 23 (1929), pp. 1-22, 26-38, figs. 6*).—This is a popular summation of horticultural work presented primarily with a view to aiding the visitor.

According to C. W. Ellenwood, Northern Spy, Baldwin, Rhode Island, Rome, Northwestern Greening, and Grimes apples averaged during the period 1910-1927, 504, 636, 652, 692, 796, and 824 bu. per acre of 40 trees. Data reported by J. H. Gourley on the effect of various amounts of pruning on apple and peach yields indicated a general tendency for pruning to reduce yields. As determined by J. S. Shoemaker, lightly pruned Elberta peaches developed more twigs in their third season than did heavily pruned trees, but the percentage distribution in the various length classes was not greatly different. Both on heavily pruned and lightly pruned trees blossoming and fruiting was greatest in primary twigs between 0.25 and 0.5 in. in diameter. In respect to length, twigs from 4 to 12 in. long were the most productive in both the heavily and lightly pruned trees.

Comparing grass mulch and tillage-cover crop treatments in a block of Stayman and Delicious trees, Ellenwood and F. H. Ballou found that consistently larger yields were obtained with tillage-cover crops and at a lower cost per bushel of fruit. Quality and color were not significantly different. At the Hamilton County and Clermont County Farms grass-mulched trees slightly outyielded the tillage-cover crop trees. As determined by Gourley, soil nitrates were highest beneath straw-mulched trees and lowest beneath trees in sod.

As found by Gourley and Ballou, sulfate of ammonia was as beneficial as nitrate of soda for apples. For peaches a complete fertilizer was somewhat better than either nitrate of soda or sulfate of ammonia. Determinations by Gourley of catalase activity, total nitrogen, pectin, respiration activity, titrable acidity, and pH of the flesh of apples fertilized with nitrate of soda and with other materials failed to show that nitrate of soda hastened breakdown of

fruits. Apples from highly fertilized trees were not quite so well colored and developed a little scald. Ellenwood found that thinning of Baldwin apples increased size and quality of fruits without loss of yield.

Fruit setting studies pursued by F. S. Howlett showed that one apple to every third flowering spur is sufficient to give a good crop of Stayman Winesap. Flowers of Stayman Winesap were more susceptible to frost than were Grimes or Jonathan. Stayman Winesap pollinated with Stayman Winesap, Delicious, Gallia Beauty, Grimes, and Jonathan had set 0.5, 15.7, 13, 12.1, and 12.9 per cent after the second drop. Ensee, Gallia Beauty, Golden Delicious, Rome, Yellow Transparent, and York Imperial were also good pollinizers for Stayman Winesap. Well fertilized Stayman Winesap trees set better than did those in sod without fertilizers. Studies with the Delicious apple showed this variety to be insufficiently self-fertile and that good growing conditions promoted larger sets of fruit. As pollinizers for Delicious, McIntosh, Gallia Beauty, Grimes, Jonathan, Yellow Transparent, Gano, Golden Delicious, Rome, and York Imperial are recommended, with Richared and Starking listed as valueless. Delicious flowers are deemed more susceptible to frost injury than any other commercial variety grown in Ohio. Jonathan, Grimes, Rome, Gallia Beauty, and Baldwin require cross-pollination in order to produce good crops.

Howlett and C. May found that lime sulfur, 1 to 60, at the 2 to 3 weeks spray slightly reduced the set of Ensee and Grimes but that 1 to 100 or greater had no effect. According to Howlett thinning the cluster to one fruit just prior to the 2 to 3 weeks' spray materially decreased the percentage drop, warranting early thinning of summer varieties provided a slightly larger number of clusters were left than in later thinnings. Gourley and Howlett found that ringing of apple trees in late May or early June did not prevent normal cropping in vigorous trees and was useful in bringing tardy trees into bearing.

Spraying and dusting experiments conducted by Ballou and I. P. Lewis suggest that well-timed and properly prepared sprays are most effective in combating apple scab, but that dusts give good protection. Modified and diluted sprays were safely used following bloom in combating scab. Ellenwood presents data on the amount of spray used on 8-, 15-, and 36-year-old apple trees and the cost per gallon of the applied spray. Comparing no wraps, shredded oil paper, oil wraps, and plain wraps for keeping apples, Ellenwood found that oil wraps or shredded oil paper were effective and gives data on costs.

Records taken by J. S. Shoemaker on over 37,000 runners of the Premier strawberry showed 46.6 per cent to be formed after October 15, with only a small percentage rooting after that date. Black raspberries were layered most successfully when the tips had lengthened out with small curled leaves. The use of small layers led to poor stands. One tip plant per lateral gave best results.

As determined by I. C. Hoffman, mulching tomatoes with manure and other materials materially reduced yields. The removal of leaves from below the first and second clusters of tomatoes reduced yields 7.5 and 18.19 per cent, respectively. Tomato plants grown from seed sown in December produced 26.5 per cent more fruit than did those sown in January. Feeding greenhouse tomatoes with soluble nitrogen at intervals of 1 week to 10 days until the fruit of the top clusters was about half grown gave increases amounting to as much as 25 to 30 per cent.

Fertilizer studies at Marietta conducted by D. Comin showed manure to give the highest yields of tomatoes but chemical fertilizers to be more profitable. Cabbage responded best to complete fertilizers. Nitrogen increased cab-

bage yields in every case irrespective of the form used. Superphosphate was beneficial in limited quantities, and lime proved essential on acid soils. Cucumbers gave the most marked response to manure and nitrogen fertilizers and required relatively small quantities of superphosphate and no calcium except on decidedly acid soils. Nitrogen alone gave profitable increases in the yield of sweet corn. All four crops yielded as well or better from delayed as from prior-to-planting applications of nitrogen. No difference was found between nitrate of soda and sulfate of ammonia. On the whole, chemical fertilizers and cover crops were quite as effective as manure. Celery, according to Comin, responded to large applications of fertilizer, nitrogen proving the most important material. Supplementary manure in addition to a basic treatment of 1,000 lbs. of a 2-8-16 material failed to increase yields as much as did 500 or 1,000 lbs. more of the same mixture. Earliest was the first variety of white and Banting the first yellow sweet corn to ripen, according to R. Magruder. Increased yields of sweet corn were secured by reducing planting distances. Paper mulch studies conducted in 1928 with various garden plants showed general but highly variable increases in yield over cultivated areas. Based on several years' observations, it is concluded that paper is particularly favorable to early, quick-maturing crops, warm-season crops, and during droughts. Compared with tilled soil, the temperature under paper was increased as much as 8° and moisture content was generally higher, but no consistent differences were noted in nitrate nitrogen. Higher temperature and higher moisture resulted in more rapid and larger germination and quicker maturity.

Studies by W. W. Wiggin upon the propagation of ornamental plants showed that care in watering, shading, and heating of cutting benches was more important than the media in which grown. Cuttings made between the nodes rooted better than at the nodes, and untrimmed cuttings rooted better. Cuttings from plants in partial shade and fertilized with nitrate rooted better than those from plants in full sunlight without added nitrates. Work on soil acidity in greenhouse soils is again reviewed (E. S. R., 61, p. 640). New unsterilized soil did not give sufficiently increased size of chrysanthemum blooms over sterilized old soil to warrant the expense in changing. For anemones and pompons 10 by 10 in. spacing gave larger returns than did 10 by 14 in.

[Fruits and vegetables at the Porto Rico Insular Station], F. A. LÓPEZ DOMÍNGUEZ (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt. 1927, Eng. ed., pp. 31, 32, 33, 34*).—Brief cultural and varietal notes are presented on various fruits and vegetables.

Premature seeding of celery, H. C. THOMPSON (*New York Cornell Sta. Bul. 480 (1929), pp. 50, figs. 15*).—Following earlier reports on the subject (E. S. R., 58, p. 640), herein is presented a summation of the results of studies on the nature and causes of premature seeding in celery.

The temperature to which young plants were subjected was found the most vital factor concerned in time of seeding. The subjection of young plants before setting in the field to temperatures averaging between 45 and 50° F. for 30 days always resulted in the development of a large percentage of early seed stalks. Decreasing the period of exposure to these temperatures decreased the amount, but even 10 days in 1928 resulted in 8 per cent of seed stalks. At the same time comparable lots held at temperatures above 60° produced no early seed stalks. The field studies were checked closely by results in the greenhouse. A check in growth, except by actual freezing, produced yellow color of the foliage, believed indicative of deficient nitrogen.

Chemical analyses of plants from low and high temperature treatments failed to show any definite relation between the actual quantity of any constituent and the subsequent behavior of the plants. On the other hand relative quantities of the various materials did have an apparent influence on subsequent growth. Plants which in the early stage of growth had a high proportion of amino nitrogen and of alcohol insoluble nitrogen went to seed if later conditions were at all favorable, while those with relatively low proportions of these nitrogen fractions did not go to seed. A possible relationship is suggested between the synthesis of certain amino acids and subsequent seeding. No consistent differences in sugar content were recorded between seeding and nonseeding plants.

Varieties and strains differed in their inherent tendency to produce premature seed stalks. In general, the rank-growing, early-maturing kinds were most likely to go to seed prematurely. However, the environment under which plants were grown appeared to govern the expression of these inherent tendencies.

Species and varietal crosses in cucurbits, A. T. ERWIN and E. S. HABER (*Iowa Sta. Bul.* 263 (1929), pp. 341-372, figs. 26).—Discussing the origin of the three important cucurbit species, namely *Cucurbita pepo*, *C. moschata*, and *C. maxima*, the classification of which was previously discussed (E. S. R., 58, p. 838), the authors present the results of a genetic study of relationships between the several species. As determined by E. F. Castetter, the diploid number of chromosomes in the three species as given were 40, 48, and 40, respectively, with no significant difference in size or shape in microsporogenesis nor in root tip mitosis. Descriptions are given of the species and of groups within the species.

Of a total of over 3,000 pollinations, including reciprocals, there were secured only 369 fruits, over 99 per cent of which were without seeds. Symptoms of impotence or physiological weakness characterized most of the progeny. Back crosses, however, resulted in fertile seeds, and varietal crosses within any one of the species were readily accomplished. The cross between *C. pepo* and *C. moschata* and reciprocal was not difficult, leading to the conclusion that incompatibility rather than impotency may be concerned. Records taken on certain inbred lines lead to the deduction that pure lines of cucurbits may be maintained at a high degree of productivity and vigor through selection of prolific strains. Data taken on the proportion of staminate and pistillate flowers in the Table Queen variety of *C. pepo* gave a flower sex ratio of approximately 12 staminate to 1 pistillate bloom.

Some stock and scion observations on apple trees, R. H. ROBERTS (*Wisconsin Sta. Research Bul.* 94 (1929), pp. 39, figs. 33).—Continuing earlier work (E. S. R., 58, p. 139) upon the relation of scion variety to the character of root growth in the apple, the author presents further evidence to show that the scion is an important factor in tree uniformity and growth, especially in the case of scions grafted directly on the piece root. Budded trees and those which were grafted some distance above the crown had, on the other hand, variable root types, more like those of the original seedlings. The root types of double worked trees in which the dwarfing stock was intermediate were generally typical of the intermediate variety. Differences noted in the influence of scion varieties on root growth of double worked trees led to the grouping of varieties into dominant, intermediate, and incompatible classes. Anatomical studies of the roots of double worked trees suggested that dominant scion varieties influence the structure of growth formed after grafting.

An analysis of approximately 40,000 measurements made by A. C. Gossard on the growth of scions budded high on yearling piece root grafts tended to

show that the amount of growth made by the scion is usually quite independent of the stock. The growth of the buds was much more uniform than that of the seedlings upon which grafted. In certain cases, however, the stocks manifestly affected top growth.

Further studies of the influence of the position of the top bud of the scion upon tree growth again indicated the advantage of placing the top bud directly above the point of callus union. Adhesive tape wrapped about the graft tended to prevent early-season callus knots. Inconsistent results were obtained with scions cut from the basal, central, and apical portions of shoots. Scions from the same source varied from year to year in percentage of successful unions. Nursery trees tended to maintain the same relative differences in size that obtained in the first year, although severe cutting back, as in budding, was observed to markedly increase uniformity. Of 12 scion varieties tested, Jonathan alone was invigorated by the stock. Certain instances of physiological incompatibility of stock and scion were noted.

Further investigations on the harvesting, storing, and ripening of pears from Rogue River Valley, H. HARTMAN, F. C. REIMER, and R. K. NORRIS (*Oregon Sta. Bul. 254 (1929), pp. 23, fig. 1*).—Further studies (E. S. R., 58, p. 140) enlarged to include a number of pear varieties, Anjou, Comice, Bartlett, Seckel, Howell, and Winter Nelis, bear out earlier conclusions, principally that pears have a definite storage life beyond which they will not ripen satisfactorily and that temperature after picking is the most important factor involved in storage

Of various tests for maturity utilized the pressure tester again gave the most reliable results. Bartlett, Seckel, Howell, Bosc, Anjou, Comice, and Winter Nelis developed their maximum dessert and storage quality when picked at pressures of from 33 to 26 lbs., 23 to 20, 27 to 24, 28 to 24, 24 to 19, 19 to 16, and 28 to 24 lbs., respectively. Beginning with Bartlett and ending with Winter Nelis the picking season in the Rogue River Valley extended over a period of approximately 75 days. Removal of a portion of the crop of a tree tended to delay maturity of the remainder.

Records on the storage life of varieties indicated that Bartlett may be kept from 40 to 50 days, Bosc, Comice, and Seckel 90 to 100, Howell 100 to 120, Anjou 150 to 180, and Winter Nelis 160 to 180 days. In respect to time required for fruit to reach prime condition at 65° F. following removal from storage Bartlett required 8.3 days, Seckel 12, Howell 9.1, Bosc 9.6, Anjou 10.1, Comice 7.3, and Winter Nelis 11.4 days, with only slight differences caused by duration of the storage period.

Development of runners and runner plants in the strawberry, G. M. DARROW (*U. S. Dept. Agr., Tech. Bul. 122 (1929), pp. 28, figs. 14*).—Discussing briefly the physiology of the runner plant and its close anatomical relation to secondary crowns and inflorescences, the author reports on various propagation studies relating to the influence of variety, time of rooting, fertilizers, pruning, etc., upon runner formation and runner performance in the strawberry. Horticultural varieties differed notably in the number and length of runners produced and in the tendency for the runners to branch. Missionary and Klondike, for example, produced many branch runners, while Howard 17 produced very few. Some ever-bearing types were observed which produced no runners at all.

In fruiting plantations in the vicinity of Washington, D. C., runner production began about the end of the fruiting period and continued until freezing weather. From work of other investigators, it is concluded that organic forms of nitrogen particularly favored plant production. Propagation records upon nine varieties at Glenn Dale, Md., showed marked quantitative and seasonal

differences in runner production. The plant production records of undisturbed and runner pruned Howard 17 plants are diagrammed. The removal of runners as they appeared greatly increased the total number to form. In general, runner plants rooting during July and August were the most productive the following year. Runners rooting after August 15 produced notably less flowers than those rooting earlier. That runner production lessens the yield capacity of the mother plant was shown in over twice as many berries from plants with all runners removed as from those allowed to carry an average of 4.5 runners. The size of plant proved a satisfactory criterion to subsequent growth and fruiting performance.

Better lawns, F. A. WELTON and R. M. SALTER (*Ohio Sta. Spec. Circ. 18* (1929), pp. [1]+16, pl. 1, figs. 9).—This is a discussion of the preparation and care of lawns based largely on the results of plat studies. That trees injure grass by reducing soil moisture and nutrients as well as light was indicated in determinations made in August and September, 1927, under pine and maple. The average amount of nitrates under the pines was 73 per cent and under the maple 85 per cent of that in adjacent open ground. Moisture under the pines averaged 84 per cent and under the maple 89 per cent of that in the open. Lime alone was not an adequate fertilizer for lawns. The plat receiving hydrated lime at the rate of 100 lbs. per 1,000 sq. ft. per annum yielded only 8.5 per cent more grass than did the check, while the plat receiving 23 lbs. annually of a 10-6-4 split in three applications yielded 91 per cent more than the check. A plat to which clippings were returned yielded in 1928 55 per cent more grass than a plat from which clippings were removed.

House plants and their care, H. O. YATES, JR. (*New Jersey Stat. Circ. 217* (1929), pp. 24, figs. 15).—A general discussion.

FORESTRY

Forest planting in the Lake States, J. KITTEEDGE, JR. (*U. S. Dept. Agr. Bul. 1497* (1929), pp. 88, pls. 6, figs. 7).—A general outlook on silvicultural needs and operations in this region.

Citing the fact that there are approximately 20,000,000 acres of potential forest lands in Minnesota, Wisconsin, and Michigan now producing no valuable growth, the author discusses in detail the history of forest planting in this area, existing species, present planting practices, causes of failure and their control, costs of planting, growth rates of planted trees, and possible profits that may accrue. A reforestation policy aimed to encourage public and private planting is outlined. Numerous references are made to the results of other investigations in this and in similar regions.

In the case of 2-year-old seedlings of Norway pine planted each month from April to November in 1925 on an open, sandy site in the Huron National Forest it was observed that midsummer plantings gave much lower survival than did those of spring or autumn. In 1926, April to July plantings were less successful than those for August to October.

Appended are tables giving stumpage values at various ages for Norway pine, white pine, white spruce, and jack pine.

Timber growing and cutting practice in the lodgepole pine region, M. W. THOMPSON (*U. S. Dept. Agr. Bul. 1499* (1929), pp. 54, pls. 8, fig. 1).—This is one of a series of bulletins (E. S. R., 59, p. 143) pointing out the essential measures needed for keeping forest lands productive and for increasing forest output in the principal forest regions of the United States and is preceded by

the usual introductory statement by W. B. Greeley. The region covered by this paper includes the commercial range of lodgepole pine in the Rocky Mountain and intermountain areas where lodgepole pine is the most important type, often occurring in pure, even-aged stands. Other species include Douglas fir, Engelmann spruce, limber pine, and alpine fir, with blue spruce and bristlecone pine occurring in the southern portion of the area. Due to high altitude and frequent occurrence of shallow, rocky soil, growth is slow. Railroad ties, mine props and timbers, telephone poles, and lumber are important forest products of this region.

In considering silvicultural practice for the area it is pointed out that fire protection should be a highly important feature, since fires are extremely destructive to lodgepole pine because of the dense stands. Plentiful reproduction usually follows the burning of stands of cone-bearing age, but fires may completely destroy immature stands. Lodgepole pine, Engelmann spruce, and Douglas fir were found to produce seed at 15, 25, and 25 years of age, respectively.

In discussing measures needed to keep forest lands of this region in a productive condition attention is paid to fire protection and slash disposal. Cutting practices which preserve advanced reproduction and allow for frequent light harvests rather than clear cutting are favored.

Factors affecting the cost of tractor logging in the California pine region. M. E. KRUEGER (*California Sta. Bul. 474 (1929), pp. 44, figs. 11*).—Continuing the series of bulletins on cost studies (E. S. R., 51, p. 44), data are presented on costs of tractor yarding in three different forest areas in the Sierra region. The tractors used in the several operations were all of the 60 h. p. track laying type, and the predominant log length was 32 ft. Two methods of using tractors were studied, namely, ground skidding and yarding with Robinson big wheels.

As in the case of steam donkey yarding, other factors being equal, small diameter logs cost more to yard by ground skidding than did large diameter logs, chiefly owing to the difficulty in maintaining a high average load per trip. However, the difference was not as great as in the case of donkey yarding. The cost per 1,000 bd. ft. increased very rapidly below 20 in. in diameter, making it advisable not to cut below 10- to 12-in. diameters. The size of the load was the biggest factor affecting the cost of yarding. Below 800 bd. ft. the cost per 1,000 bd. ft. increased very rapidly. Data suggested that 2,400 bd. ft. was a practical maximum load for skidding. Slope was found an important factor in determining skidding costs, those of from 10 to 30 per cent being ideal, with 50 per cent as a practical maximum. Profitable yarding distances were found to be closely related to railroad costs, with greater possibility of excessive costs from yarding short of the economic maximum rather than beyond.

Concerning the use of hydraulic big wheels, bunching costs were found to be a very large factor in yarding operations, the actual cost of bunching being usually in direct proportion to the number of pieces handled per bunch. Summing up, the author states that the main requisite for successful tractor logging is proper organization to see that there is adequate equipment with which to maintain high average loads per trip.

DISEASES OF PLANTS

Miscellaneous investigations (*Missouri Sta. Bul. 272 (1929), p. 41*).—Studies by I. T. Scott are briefly reported. These include narcissus leaf blight or die-back caused by a Phoma-like organism; peony bud blight, due to *Macro-*

porium sp.; corn root rot. due to *Pythium* sp.; and potato blackleg, caused by *Bacillus atrosepticus*.

Diseases and injuries of cultivated plants during 1925 [trans. title], E. WERTH (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 32 (1927)*, pp. 158, figs. 19).—A report is given of weather relations during 1925 and their influence on cultivated plants, by E. Werth (pp. 7-24), a statement regarding crop results of disease and pest injuries during the year, by H. Pape and S. Wilke (pp. 24-28); and detailed systematic accounts, by different authors, of different causes of loss, including insect pests (pp. 28-150).

Some diseases of unknown nature observed on green manure crops [trans. title], M. B. SCHWANZ (*Dept. Landb., Nijv. en Handel [Dutch East Indies]*, *Korte Meded. Inst. Plantenziekten, No. 5 (1927)*, pp. 19, figs. 11; *Eng. abstr.*, pp. 14-19).—Diseases of green manure crops, recently observed and still undetermined as to nature or causation, include as described a witches'-broom or curly disease of *Crotalaria anagyroides* and *C. juncea*, "curvy" disease of *C. anagyroides*, and curly disease of *Calopogonium mucunoides*. Virus causation has been suspected in each case.

Supplements for copper fungicides, E. B. HOLLAND, C. O. DUNBAR, and G. M. GILLIGAN (*Massachusetts Sta. Bul. 252 (1929)*, pp. 93-112).—A report is given of investigations of various materials used to stimulate the activity of copper fungicides, increase their spreading and adhesive powers, and prevent decomposition of the mixtures.

The authors conclude that the efficiency of insoluble copper fungicides is dependent largely on the degree of dispersion and other physical characteristics, as determined by a suspension, which is considered the simplest and most practical method of evaluation. Wetting, spreading, and adhesiveness were found to be so closely correlated and interdependent that complete differentiation was impossible. It is claimed that so-called soluble copper is not a proper criterion of fungicidal activity, as various organic compounds produce filtrable copper, the activity of which is lower than that of soluble inorganic compounds which are readily ionized. Suspension, although largely dependent on dispersion, was found to be increased in a measure by supplementary products. This was also found true of wetting, spreading, and adhesiveness. The authors claim that protectors may retard the formation of larger aggregates, crystallization, decomposition, and the interactions between noncompatibles.

Of the various supplements tested, wheat flour, glue or gelatin, soap, and tannic acid were found promising in that they seemed to increase the efficiency of the spray in more than one aspect.

The plant rusts (Uredinales), J. C. ARTHUR (*New York: John Wiley & Sons; London: Chapman & Hall, 1929*, pp. V+446, figs. 186).—The author, in collaboration with F. D. Kern, C. R. Orton, F. D. Fromme, H. S. Jackson, E. B. Mains, and G. R. Bisby, has presented a work giving a general account of the rusts, with special reference to their biological relations.

The book is very largely the outgrowth of investigations begun and continued for many years in the laboratories of the Indiana Experiment Station. The taxonomic results of the work were published in the seventh volume of the *North American Flora*.

The present work, after a general account of the nature of rusts, gives a historical review of the subject. Other chapters treat of the development and classification of rusts, their cytology and morphology, dissemination and geographic distribution, physiology, specialization, teratology and pathology, economic considerations, and methods of investigation.

A list of about 1,000 titles of cited literature is given.

Additional hosts of *Fusarium oxysporum* var. *medicaginis*, J. L. WEIMER (*Jour. Agr. Research* [U. S.], 39 (1929), No. 5, pp. 351-353).—As a result of growth tests at West Point, Miss., and Manhattan, Kans., in which a considerable number of economic plants were subjected to infection by *F. oxysporum medicaginis*, hairy vetch, common vetch, and garden peas were found to be susceptible to the alfalfa wilt-producing fungus.

Comparative value of the size of *Phytophthora* sporangia obtained under standard conditions, L. H. LEONIAN and H. L. GEER (*Jour. Agr. Research* [U. S.], 39 (1929), No. 4, pp. 293-311).—The results are given of an effort to compute the comparative value of the size of sporangia of different species of *Phytophthora* obtained under controlled conditions. Because of the wide variation in the different strains of the same species, it was found that the size of the sporangia can not be considered a factor of primary importance in taxonomy. Oogonia and oospores were found to show similar size variations, and they are, therefore, considered no more valuable in this respect.

The authors consider *P. infestans*, *P. thalictri*, and *P. phaseoli* as well-defined species, and probably *P. cinnamomi*, *P. cryptogea*, *P. erythrosepica*, and *P. pini* are distinctive enough to be retained. It is claimed that a number of other species which have been described by various authors should be referred to accepted species.

A number of forms are referred to *P. omnivora*, which the authors divide into six arbitrary types based on sporangia characters. These characters, however, are not considered stable enough to warrant specific names for the forms.

Influence of varietal resistance, sap acidity, and certain environmental factors on the occurrence of loose smut in wheat, V. F. TAPKE (*Jour. Agr. Research* [U. S.], 39 (1929), No. 5, pp. 313-339, figs. 4).—A report is given of results of studies made to determine a possible correlation between high acidity in the cell sap of wheat of different varieties and their resistance to loose smut, and the extent to which certain environmental factors may influence the amount of disease exhibited by a particular variety.

A comparative study was made of the anthesis of a susceptible and a resistant variety of wheat to determine a possible relation to resistance. None was found, the extent and duration of glume opening being practically the same for both varieties. The varietal-resistance studies, in which inoculum was artificially inserted within the flowers, showed further that resistance was not due to escape from inoculum. Some indication was found that a very early or very late blooming may enable a variety to escape infection provided the variety itself is free from loose smut. The stage of anthesis in which wheat flowers were inoculated proved to be a factor in the susceptibility of the plants to infection. Inoculation while the pollen was still immature caused higher infections than those when the pollen was ripe, but the inoculation of several highly resistant varieties when the pollen was immature did not affect their resistance.

The varietal resistance and susceptibility of 102 recognized varieties and 132 different lots, mostly pure-line selections of eastern wheats, were tested from 1 to 3 years, the flowers being inoculated by hand. The only durum wheat included in the experiment was highly resistant, and the 3 club wheats tested were strikingly susceptible. In the common wheats the range of resistance ran from high susceptibility to apparent immunity. Thirteen varieties were found to be highly resistant or immune under the conditions of the experiment. Pure-line selections of 2 varieties of wheat, which were resistant to stinking smut, were highly resistant to and immune from loose smut.

Evidence was obtained indicating the presence of physiologic forms in *Ustilago tritici*. No correlation was found between the H-ion values or the titrable-acid values of the juice of wheat plants and their ability to resist the invasion of *U. tritici*. More winterkilling occurred in plants grown from infected seed than in plants from uninfected seed at Rosslyn, Va., and at Ithaca, N. Y. Wide differences in the vegetative vigor of wheat plants grown from seed infected with the loose smut fungus had little influence on the susceptibility of the varieties.

Some factors involved in the winterkilling of alfalfa, J. L. WELMER (*Jour. Agr. Research* [U. S.], 39 (1929), No. 4, pp. 263-283, figs. 4).—The author presents data accumulated during two years' work in the greenhouse and laboratory dealing with the freezing and killing points of alfalfa root tissue and some factors influencing them.

The freezing point of alfalfa root tissue was determined by the thermoelectric method, and there was little correlation found between the freezing points and the diameters of the roots. There appeared to be a slight correlation between the freezing points of sections of alfalfa taproots taken near the crown and similar sections taken 10 cm. below. The average freezing point of root tissue in or near the cambium was -2.11° C., while that of the center of the root was -2.3° . The freezing temperatures for alfalfa roots under other conditions are given.

It was found that the amount of cold which alfalfa roots can withstand depends upon their hardness, the amount of insulation afforded by the substratum in which they are embedded, soil moisture, and other factors. Roots of non-hardened plants with abundant carbohydrate reserves froze less easily than roots of plants that had been deprived of light for some time. This is believed to be due to a change in the physiological condition of the cells brought about by a lack of root reserves.

The author claims that by using the dilatometer method a correlation was found to exist between the amount of bound water and cold resistance of hardened and nonhardened plants, confirming the conclusions of Rosa (*El. S. R.*, 46, p. 827) and Lott (*El. S. R.*, 56, p. 644).

Beet mosaic [trans. title], K. BÖNING and E. SCHAEFFNIT (*Forsch. Geb. Pflanzenkrank. u. Immunität Pflanzenz.* No. 3 (1927), pp. 81-128, figs. 17).—This article includes a review, with references (bearing upon general and special phases), of the literature of beet mosaic, followed by an account of the etiology, internal features, transmissibility, physiological concomitants, agricultural significance, and control measures.

Notable is the close association of this disease and of its transmission with the presence of the black louse (*Aphis fabae*), and it is thought that beet mosaic control is closely bound up with black louse control. Precautionary methods are discussed.

The downy mildew of the hop in 1926, E. S. SALMON and W. M. WARE (*Jour. Min. Agr. [Gt. Brit.]*, 33 (1927), No. 12, pp. 1108-1121, pls. 4).—In the year 1926, as a development in England following that of 1925 (*El. S. R.*, 59, p. 51), attacks occurred by the downy mildew on ripe or nearly ripe cones in a number of hop gardens, spoiling the color, sometimes leading to premature picking, and in a few cases completely ruining the crop. The proportion of the hops affected was, however, small. A detailed but brief account of all the known outbreaks is given in the present article, with statements as to the outbreaks and distribution on the Continent, and with certain facts observed as to the life history and the control measures considered most effective.

Early removal of all affected parts, in particular the so-called "spiked bines," proved to be preventive when properly carried out in 1926. The variety Tolhurst proved, under the conditions, to be very susceptible; Fuggles was more resistant. Confirmation was obtained that the lateral shoots produced below the spiked tips of bines, 5 to 7 ft. high, are usually healthy and that they may be rather safely trained up; also that the spawn (mycelium) may be present in the rootstock of the hill. The flowers of the male hop may be seriously attacked.

Preliminary results of a rotation test in connection with slime disease (*Bacterium solanacearum*) in *Arachis hypogaea* [trans. title], M. B. SCHWARZ (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Korte Meded. Inst. Plantenziekten, No. 3 (1927), pp. 11+[2], pls. 2, fig. 1; Eng. abs., pp. 10, 11*).—On irrigated land near Buitenzorg, planted in the west monsoon with rice and commonly in the east monsoon with *A. hypogaea* (katjang tanah), *Soja hispida*, *Vigna sinensis*, *Capsicum annuum*, *Solanum melongena*, *Ipomoea batatas*, *Zea mays*, and *Cucumis sativus*, it was found that the first five named as east monsoon crops were susceptible to *B. solanacearum*, but that the loss in *A. hypogaea* was most important. A rotation test was accordingly started in 1923 in which *A. hypogaea* was grown in successive years, also in one-year rotations with the other crops. In the tests (considered preliminary) carried out during 4 years, continued culture of *A. hypogaea* on irrigated land during the dry season caused increasing loss by the slime disease due to *B. solanacearum*, whereas a one-year rotation with any of the other crops gave an adequate decrease of that disease. These facts indicate, presumably, a differentiation in the bacterial strains regarded as significant and probably as of importance, rendering the rotation practice very simple.

Physiological studies of the tomato wilt organism, *Fusarium lycopersici* (*Missouri Sta. Bul. 272 (1929), pp. 40, 41*).—Further studies by I. T. Scott (*E. S. R.*, 58, p. 441) of mats of a monosporic strain of *F. lycopersici* are said to have shown that the critical H-ion equilibrium existed for this fungus at or near pH 5.5. Titration curves for the dialyzable portion of ground dried mycelium and the nondialyzable residue showed buffer effect. It was assumed that buffer effect of the former was due to organic salts and acids, while in the case of the latter the effect was due to proteinaceous materials.

The woolly-knot type of crown gall, *E. A. SIEGLER* (*Jour. Agr. Research [U. S.]*, 39 (1929), No. 6, pp. 427-450, figs. 8).—A report is given of experiments in which apple grafts and seedlings were inoculated with an organism tentatively referred to as the apple strain of the crown gall organism (*Bacterium tumefaciens*).

This so-called apple strain was found to cause the woolly knot type of crown gall or hairy root prevalent on root-grafted apple trees. It is believed probable that this strain is identical or closely related to the so-called nonpathogenic strains of *B. tumefaciens* reported by other workers. When apple grafts were immersed in an inoculum of the apple organism previous to callus formation, abundant infection occurred, but when immersed in the inoculum after callus had formed, infection was not so abundant. Another strain of the crown gall organism failed to cause infection when inoculated under these conditions.

From his experiments, the author believes that the nutritional conditions at the point of inoculation may be a factor of greater importance than the condition of rapid growth in the amount and kind of infection secured. The woolly knot type of crown gall on apple grafts caused by the apple organism is considered to be quite distinct from the comparatively smooth type of gall with slight or no root developments caused by certain other strains of the crown gall organism.

Aerial crown gall of the apple, E. A. SIEGLER and R. B. PIPER (*Jour. Agr. Research* [U. S.], 39 (1929), No. 4, pp. 249-262, figs. 4).—The authors claim that malformations which are morphologically identical with those known as aerial crown galls, stem tumors, or burrknots have been produced consistently on the apple by means of inoculations with the apple strain of *Bacterium tumefaciens*, but the organism was reisolated from these galls only within comparatively short periods after infection.

It is believed that the evidence submitted lends support to the hypothesis that the natural occurrence of these malformations is due to infections with the apple strain of the crown gall organism. It is not considered to preclude the possibility that other agencies or factors may also cause these malformations.

"Reversion" in black currants: Its causes and eradication, J. AMOS, R. G. HAITON, R. C. KNIGHT, and A. M. MASSEE (*East Malling [Kent] Research Sta. Ann. Rpt.*, 15 (1927), pt. 1, pp. 43-46).—Reversion in black currant bushes has extended greatly in area since it became well known as early as 1912. The situation is doubly serious in that, while the bushes affected soon cease to bear, they remain centers for further spread of the trouble. This has been shown to be transmissible from bush to bush by grafting, though it appears to be perfectly safe to plant a healthy young bush where a reverted one has been removed.

At least one possible carrier is the big bud mite, though these mites are very commonly present on plants which do not develop big buds. The evidence as to transmission is, as yet, insufficient, but control of big bud mite appears imperative, as is also the removal of all reverted plants as soon as they can be identified as such.

Infection of fruit of citrus by *Pseudomonas citri*, H. R. FULTON and J. J. BOWMAN (*Jour. Agr. Research* [U. S.], 39 (1929), No. 6, pp. 403-426, figs. 6).—The results are given of greenhouse experiments on the invasion of fruit tissues by the canker organism (*P. citri*), the rate of multiplication of the bacteria in the tissues, and the resultant growth reactions of the fruit.

A quantitative method is described for estimating from wound inoculations the number of bacteria present at various stages in the development of canker lesions.

When punctures were made into the oil glands of citrus fruits, infection by *P. citri* was seriously hindered. Fruit wounds as much as 8 hours old became infected much less readily than freshly made wounds, and if allowed to dry the wounds decreased in infectibility more rapidly than when kept moist. Weak grades of inoculum were found to produce lower percentages of infection than strong grades, and the resulting cankers began to show after a longer interval and developed more slowly. With a given strength of inoculum, infection was found to be greater in amount and in degree on wounded leaves than on wounded fruits. The size of the fruit was found to influence the amount and degree of canker development, very small fruits being with difficulty infected by inoculation, while intermediate sizes showed the best development of canker lesions. On large fruits lesions developed less readily. The majority of infections were found to occur at visible wounds. The so-called stomatal infections occurred most abundantly on smaller sizes of growing fruits than did wound infections, but stomatal infections failed to develop at an upper size range some 10 mm. less than for wound infections.

Periodical testing of infected wounds indicated that the multiplication of the canker bacteria took place in about equal degree regardless of the size of the fruit up to a stage of full maturity on the trees. Fully ripe fruit inoculated through wounds after removal from the tree did not give evidence of any

definite increase of the canker organism. A maximum number of bacteria was found to be reached in a few days at ordinary temperatures, after which a rather uniform level was maintained for a considerable time. The multiplication of bacteria in the tissues was found to be independent of the development of external evidences of canker. A maximum development of bacteria in lesions is said to result from weak as well as from strong inoculum, a slightly longer period being required in the former case.

The development of *Penicillium* rot had a decided inhibiting or killing effect on *Pseudomonas citri* in recently developed lesions in the fruit peel.

Marked differences were found between various types and varieties of citrus fruits in respect to the readiness with which infections occurred. Tests for persistence of viable canker organisms are said to indicate that they may die out within a period of from 5 to 6 months, but under certain conditions they may persist for longer periods.

Inoculation tests of oranges under orchard conditions showed a general agreement with the findings from experiments conducted in the greenhouse, as did infection tests of green fruits removed from trees and held in moist chambers. At about 45° F. green inoculated fruit in a moist chamber required much stronger inoculum and a much longer time to develop the same visible reaction as similar fruit held at a room temperature of about from 70 to 75°.

Some common diseases of ornamental plants, E. L. LECLERC (*Colorado Sta. Bul.* 351 (1929), pp. 31, figs. 14).—The author gives information regarding some of the more common diseases of ornamental plants found in Colorado. The plants are arranged alphabetically, and the diseases of each are listed and discussed and suggestions given for their control.

Annual partial wilting in *Hibiscus tiliaceus*, H. CHAUDHURI (*Jour. Indian Bot. Soc.*, 6 (1927), No. 3-4, pp. 109-112, fig. 1).—In the individual plants of *H. tiliaceus* in the Lawrence Gardens, Lahore, India, a partial wilting, observed for several successive years, proved to be due to attack by *Alternaria dianthi*, which causes also a bud rot in other local plants. This *Hibiscus* organism differs physiologically from the forms agreeing with it morphologically. Though spores from *Hibiscus* infected other hosts, spores from these did not infect *Hibiscus*. The fungus produces during growth staling substances. It is claimed to have been proved that the wilting is due to an alkaline secretion and not to vascular occlusion by the fungal hyphae.

ECONOMIC ZOOLOGY—ENTOMOLOGY

National wild-life reservations (*U. S. Dept. Agr., Misc. Pub.* 51 (1929), pp. 10, figs. 2).—This is a compilation of the reservations administered by the U. S. Departments of Agriculture, Commerce, Interior, Navy, and War, respectively, arranged alphabetically according to the State, showing the area and the chief species of animals protected.

Directory of officials and organizations concerned with the protection of birds and game, 1929, compiled by T. DENMEAD and F. G. GRIMES (*U. S. Dept. Agr., Misc. Pub.* 57 (1929), pp. 12).—This is a revision of the directory previously noted (*E. S. R.*, 60, p. 158).

Mountain beavers in the Pacific Northwest: Their habits, economic status, and control, T. H. SCHEFFER (*U. S. Dept. Agr., Farmers' Bul.* 1598 (1929), pp. II+18, figs. 13).—This is a summary of information on the mountain beaver (*Aplodontia rufa*), or sewellel, a herbivorous, burrowing rodent, occurring along the Pacific coast region of southern British Columbia, Washington, Oregon, and northern California. In its natural haunts in the seclu-

sion of the forest this animal was not of economic importance, but with the clearing of lands and extension of farming operations, it has increased in numbers and in many localities has become a serious crop pest, since it will eat almost anything that farmers or orchardists can grow. An extensive study made of its life history, feeding habits, and methods for its control is reported upon. The methods of control are considered under the headings of trapping and poisoning.

Annual report of the department of zoology and entomology, R. W. HARNED (*Mississippi Sta. Rpt. 1927, pp. 25-30*).—This is a brief report of the work of the year, particularly that with the projects on the cotton aphid, pecan insects, scale insects, and crawfish.

The work on the cotton aphid by A. L. Hamner during the summer of 1926 dealt primarily with increasing the aphid infestation and controlling it. As many as 15 applications of calcium arsenate were applied on some plats before there was sufficient infestation of the aphid to try control measures. Applications of calcium arsenate, hydrated lime, and sulfur were made individually in combinations of two or all. A mixture of calcium arsenate and hydrated lime in equal parts was found to be an efficient carrier for nicotine sulfate. The dust should contain 7.5 per cent nicotine sulfate and be applied at a rate so that there would be at least 0.2 lb. of free available nicotine per acre. Two of five plats were dusted with calcium arsenate and two with hydrated lime, the additional or center plat being used as a check. On August 3 the infestation on the two calcium arsenate plats averaged 61.9 per cent, the hydrated lime plats 85 per cent, and the check plat had an infestation of 9.5 per cent. Ten days later the infestation had been reduced to 5 per cent on the calcium arsenate, 5.3 on the hydrated lime, and 5.1 on the check. The study of the winter host plants of this aphid was continued, the aphids transferred from cotton to *Rumex crispus* the preceding October having established themselves, and their descendants were still on the plants at the time of writing, April 27, 1927. Other successful transfers were made at intervals through the winter to cotton and watermelon in the greenhouse. *Lemium amplexicaule* or henbit was found during the winter to be a primary host. Several successful transfers were made to establish definitely its identity after critical periods in weather conditions.

Work with the pecan insects, conducted by J. M. Langston, Hamner, and Shaeffer, is reported upon. A study was made by Shaeffer of what appears to be a new gall mite discovered in the spring of 1926 in the orchard of the horticultural department of the college. Ten of the 28 trees in the orchard were found heavily infested with the pest, 10 to 30 per cent of the entire leaf area of the trees being infested. The pest is similar in structure and habits to the pear leaf blister mite. The mites cause the leaves to roll, and the leaf area is reduced so that the life processes are retarded or entirely stopped. The mite has never been found outside of the college orchard. On the trees sprayed with concentrated lime sulfur at the time of the bursting of the buds, only one small area of infestation is now in evidence. Mention is made of observations of the life history of the walnut caterpillar by Shaeffer, who reared 34 tachinid parasites from a cage containing 25 caterpillars. In studies of the pecan shuckworm (*Laspeyresia caryana*), Hamner found the last moth to emerge in cages on October 5. April 4 was the earliest spring emergence. In an experiment conducted it was found that larvae buried in the fall in sand to a depth of 3 in. or more failed to emerge up to the time of writing on April 27. Studies were made by Langston of the hickory-nut weevil, the flat-headed borer, and the twig girdler. The results indicate that the hickory-nut weevil has at least a 2-year life cycle.

In work with the scale insects, largely by G. Hoke, 25 of the 95 species of scale insects recorded represented species that have never before been reported from the State.

Studies of the crawfish were made during the year by R. N. Lobdell on the Mississippi River levees to determine the depth and type of holes made by the three common delta species. A trip of investigation furnished proof of the relation between sand boils that cause overflows and crawfish.

[Report of the department of entomology at the Missouri Station], L. HASEMAN and K. C. SULLIVAN (*Missouri Sta. Bul.* 272 (1929), pp. 57-62).—Brief accounts are given of the more important work of the year.

Referring to the work with the codling moth, it is said that after three years of unusually serious infestation the pest now shows a definite tendency to subside. A considerable percentage of the overwintering worms failed to emerge as moths, due in part to fungus and bacterial diseases.

In studies of mosquitoes in the State over 40 species have been identified.

In a study of the effect of heat upon insects and seeds, in which different insect species were tested, their resistance to heat was found to vary to some extent. A temperature of 125° F. maintained for a period of 24 hours was sufficient to kill all the insects tested in all the different stages. All of 20 different kinds of seeds were able to stand 140° for a period of 24 hours without injury. One lb. of carbon bisulfide per 500 cu. ft. of space at a temperature of 90° and in a tight container was sufficient to kill all insect life in 24 hours. Seeds were able to stand 1 lb. per 25 cu. ft. of space without injury. Paradichlorobenzene used at the rate of 1 lb. per 100 cu. ft. for a period of 48 hours was sufficient to kill all insect life. Used at the rate of 1 lb. to 1 cu. ft. of space, it caused no injury to seeds.

Studies of the biology and control of the strawberry crown borer are reported upon. Dust was applied in March and April at the rate of 85 lbs. of hydrated lime to 15 lbs. of arsenate of lead, and liquid at the rate of 50 gal. of water and 2 lbs. of arsenate of lead, 2 plats receiving 4 applications and 2 plats 2 applications each. The average yield of the sprayed plats was 258 qts. of berries per acre more than the unsprayed.

A dust-spraying project for the control of apple insects was carried out at McBaine on a commercial scale. The dust sprays applied controlled the insects as well as the regular liquid spray of lime sulfur and arsenate of lead. They covered the foliage better but did not stick as well. The lethal dose for a codling moth larva is said to be 0.005 gm. It is thought to be possible to eliminate the spray residue problem by using dust sprays for the late summer applications.

A list is given showing the relative prevalence of insects injurious to nursery stock as based upon reports received.

This report includes a discussion of the importance of timing the spray schedule by the dates of codling moth emergence based upon investigations conducted at Marionville, St. Joseph, and Mountain Grove in cooperation with the Missouri Fruit Station. At Columbia the moths of the spring brood began to emerge at the usual time and rapidly increased to a peak from May 20 to 25, and a few stragglers followed. At St. Joseph the emergence was a few days later than at Columbia, while at Marionville because of late snow the blossoms were behind those at Columbia, but the moths began emerging at the same time. A second peak occurred from June 17 to 20.

Collection and preservation of insects for use in the study of agriculture, M. C. MANSUY (*U. S. Dept. Agr., Farmers' Bul.* 1601 (1929), pp. II+19, figs. 18).—This is a revision, in part, of Farmers' Bulletin 606 (E. S. R., 31, p. 792).

A survey of the insect and other invertebrate fauna of permanent pasture and arable land of certain soil types at Aberystwyth, E. E. EDWARDS (*Ann. Appl. Biol.*, 16 (1929), No. 2. pp. 299-323, figs. 4).—This is a detailed account of studies conducted, presented in connection with a list of 19 references to the literature.

Insects injurious to alfalfa, S. B. DOTEN (*Nevada Sta. Rpt.* 1928, pp. 25, 26).—The parasites of the alfalfa weevil, introduced by the station in 1922, are said to be finally bringing about a reduction in the destructiveness of the pest, although not as yet to the extent of making spraying or dusting unnecessary. Tests of the efficacy of the application of the arsenicals as a dust and as a spray are said to have resulted in favor of the dusting method. It is thought that the dusting method will replace that of spraying under western Nevada conditions.

Report of the entomologist, S. S. LIGHT (*Tea Research Inst. Ceylon Bul.* 3 (1929), pp. 37-48).—In this report the insect enemies of tea are given particular consideration.

Insects in tobacco seedbeds, C. SMILE (*Nyasaland Dept. Agr., Ent. Ser. Bul.* 5 (1929), pp. 8).—A practical account of several important insect enemies of tobacco seed beds and means for their control.

Protection of log cabins, rustic work, and unseasoned wood from injurious insects, R. A. ST. GEORGE (*U. S. Dept. Agr., Farmers' Bul.* 1589 (1929), pp. II+20, figs. 23).—This is a practical account of the insects that attack the unbarked logs of the principal woods used in the construction of log cabins, rustic woodwork, etc., and means for protection. Some of the insects which cause the damage are active nearly every month of the year except December, January, and February. It is pointed out that by cutting the trees at certain seasons and by treating the wood with preventive and remedial substances practically all such insect damage can be prevented or checked.

Composition of commercial acid lead arsenate and its relation to arsenical injury, H. S. SWINGLE (*Jour. Agr. Research [U. S.]*, 39 (1929), No. 6, pp. 393-401).—The studies here reported have shown that at low concentrations of equivalent arsenic content arsenious and arsenic acids are equally toxic to peach foliage, and that at higher concentrations arsenic acid is the more toxic. Arsenic acts as a cumulative poison within peach leaves, the minimum concentration of arsenic acid toxic to peach foliage containing the equivalent of 0.0012 per cent of arsenic pentoxide. Acid lead arsenates containing less than 0.25 per cent of arsenic pentoxide in water-soluble form gave minimum foliage injury, so that nothing of practical importance was gained by further reductions in soluble arsenic. It appears to be impossible to reduce the soluble arsenic in acid lead arsenate sufficiently to prevent serious injury when used upon tender foliage. Thus it is evident that acid lead arsenate can not be safely used upon susceptible plants without the addition of some material to prevent burning. The initial soluble arsenic, within ordinary limits, has little or no effect upon the toxicity of acid lead arsenate to insects.

The sulphide sulphur content as a basis for diluting lime-sulphur for spraying, G. M. LIST (*Colorado Sta. Bul.* 352 (1929), pp. 14).—It has been found that the Baumé hydrometer test is not always an accurate method of measuring the amount of polysulfides in a solution, the presence of other soluble compounds affecting the reading. The iodine test for the sulfide sulfur appears to be more accurate than the Baumé reading. The ratio of the sulfide sulfur content of samples tested to their Baumé reading varied from 0.604 to 0.985, the ratio being higher in commercial than in homemade samples. The effective amount of sulfide sulfur in the dilute spray was found to be 3.35 per cent for San Jose scale, 2.55 for blister mite, and 0.75 for summer spraying.

The commercial samples, with the exception of two, when diluted according to the standard Baumé dilution tables carried the specified percentages of sulfide sulfur. Some carried more than these percentages. The samples of homemade material carried from 68 to 88 per cent of the specified amounts. The error in diluting homemade lime sulfurs by the Baumé tables appears to be about 25 per cent when sludge is not included. The presence of the sludge increases the error by another 5 per cent.

The iodine test overestimates the sulfide sulfur content of dry lime sulfurs. These materials, when diluted according to their sulfide sulfur content, become impracticable as insecticides.

Preliminary notes on the control of locusts (*Schistocerca gregaria*), E. HARRISON (*Kenya Colony Dept. Agr. Bul. 3* (1929), pp. 15, pls. 2).—This summarizes the methods used in grasshopper destruction, with notes on flying swarms.

Termites in buildings, T. E. SNYDER (*U. S. Dept. Agr. Leaflet 31* (1929), pp. II+5, figs. 3).—This is a practical summary of information.

Cotton-louse control, B. R. COAD, J. W. FOLSOM, and R. C. GAINES (*U. S. Dept. Agr. Leaflet 53* (1929), pp. 4, fig. 1).—A brief practical account.

The known predacious and parasitic enemies of the pea aphid in North America, C. L. FLUKE (*Wisconsin Sta. Research Bul. 93* (1929), pp. 47, figs. 53).—This is a report on the biology of the several groups of natural enemies attacking the pea aphid. The author has found 76 known predacious and parasitic enemies of this pest in North America, the most important groups in order of their importance being Syrphidae, Coccinellidae, fungus diseases, Aphidius, and Chrysopidae. These natural enemies are said to be the major factors responsible for keeping the pest under control. A list is given of 42 references to the literature.

Studies on potato virus diseases.—V, Insect transmission of potato leaf-roll, K. M. SMITH (*Ann. Appl. Biol., 16* (1929), No. 2, pp. 209-229, pls. 3).—This is a detailed account of inoculation experiments conducted with seven different species of insects in 1927, with all of which negative results were secured except in the case of the green peach aphid, which gave a high percentage of positive infections. A continuation of inoculation tests with this aphid in 1928 proved it to be an efficient carrier of the leaf roll virus.

Investigations of the woolly aphid parasite *Aphelinus mali* Hald. [trans. title], L. SPRENGEL (*Anz. Schädlingssk., 4* (1928), No. 12, pp. 151-160, figs. 3).—An account of studies of the biology of this parasite, which has been introduced and become established in the Rhine Palatinate.

The apple sucker (*Psyllia mali* Schmid.), W. SPEYER (*Der Apfelblattsäuger (Psyllia mali Schmidberger)*. Berlin: Julius Springer, 1929, pp. VII+127, figs. 59).—This is an extended account of the apple sucker or psyllid, its food plants and their distribution, geographical occurrence, morphology and anatomy, life history and habits, natural enemies, and control measures. A 14-page list of references to the literature is included.

The European elm scale (*Gossyparia spuria* Modeer), H. B. HUNGERFORD and G. A. DEAN (*Kans. Ent. Comm. Circ. 9* (1929), pp. 8, figs. 4).—A practical summary of information on this pest and its control in Kansas.

[**The cotton hopper**], C. T. AMES (*Mississippi Sta. Rpt. 1927*, pp. 38, 39, 42).—Reference is made to control work with the cotton hopper at the Holly Springs Substation, where two or three applications of finely ground sulfur were dusted on the plants with some degree of success, but with little profit unless made early.

Capsid bugs (Capsidae) on fruit trees and bushes, F. V. THEOBALD (*Southeast. Agr. Col., Wye, Bul. 6* (1927), pp. 8, figs. 4).—A brief practical account.

Australian insects imported to combat citrophilus mealybugs in citrus groves of California, H. S. SMITH and H. COMPERE (*Citrus Leaves*, 9 (1929), No. 5, pp. 12, 13, 29, 30).—A brief account of work with the Australian enemies of the citrophilus mealybug at the California Citrus Experiment Station. Earlier accounts of the work have been noted (E. S. R., 60, p. 455; 61, p. 456).

The biology and control of the sugarcane stilt bug (Phaenacantha sacharicida (Karsch) [trans. title], P. C. BOLLE and L. STAMMESHAUS (Arch. Suikerindus, Nederland. Indie, Meded. Proefsta Java-Suikerindus., 1929, No. 7, pp. 459-504, pls. 3; Eng. abs., pp. 502-504).—This is an extended account of a stilt bug known in Java for a considerable time as an insect of minor importance in sugarcane fields. Since 1926 it has changed its habits and become a permanent settler in west Java, multiplying there to an enormous extent and every year spreading over a greater area.

Mediterranean fruit fly must be watched (Citrus Leaves, 9 (1929), No. 5, pp. 1-3, 14).—An announcement of the appearance of this pest in Florida, followed by a brief practical summary of information regarding it.

The clover-flower midge (Dasynura leguminicola Lintner), L. P. WEBERLE (New York Cornell Sta. Bul. 481 (1929), pp. 35, figs. 18).—This is a report of a study of the life history and bionomics of the clover seed midge, commenced in the summer of 1919 and continued in 1920, together with observations and experiments conducted in 1921 and 1922 and into 1923, with a little work in 1924. Much of the data is presented in tabular form.

It was found that there are usually two generations of the pest in the vicinity of Ithaca, N. Y., although in certain cases there was only one generation in a season. The flight of the adults of the first generation was found to extend from late May or early June until the end of June. That of the second generation commences in late July or early August and continues until the first part of October. The length of the different stages in the development of the clover seed midge was found to be as follows: Egg stage 2.20 days; larval stage about 77 days in the first generation, about 261 days in the second generation, and in the case of three specimens in which pupation was delayed about 332 days; pupal stage for the first generation about 15 days and for the second generation about 16 days; pupal stage for first and second generations and pupae reared from collected larvae 13.69 days.

The larvae destroy the seed by feeding within the florets of the clover heads. They spend the winter in small cocoons just beneath the surface of the soil. While red clover is the chief food plant of the midge, it has been reported on white clover, alsike clover, and mammoth clover, the author having reared the pest from alsike.

Of the several enemies reported, the author has reared *Platygaster leguminicolae* Fouts and *Inostemma leguminicolae* Fouts at Ithaca. It is pointed out that early June cutting, late pasturing until the middle of June, and rotation of crops are the most effective methods of control.

A list is given of 41 references to the literature.

A mosquito survey of certain parts of South Africa, with special reference to the carriers of malaria and their control, Part II, A. INGRAM and B. DE MEILLON (*So. African Inst. Med. Research Pubs., No. 25* (1929), pp. 83-170, pls. 10).—This account (E. S. R., 59, p. 356) includes a list of mosquitoes taken as adults or reared from larvae or pupae during the survey (pp.

136-151), also descriptions of the larvae and pupae, not hitherto described, of certain South African mosquitoes (pp. 157-170).

Report of the bureau of malaria control, 1926-27 (*Porto Rico Commr. Health Rpt. 1926-27*, pp. 62-95).—This report includes accounts of the breeding of *Anopheles* mosquitoes in Porto Rico outside of the reservoir, conditions within the reservoir, preventive measures recommended, the effect of major drainage on the breeding of *Anopheles* mosquitoes, observations of screens and screening materials, observations on the blood feeding habits of *A. albimanus* and *A. grabhamii*, the precipitin test, etc.

Laboratory rearing of *Laspeyresia molesta* Busck, W. E. STENBURGH (*Sci. Agr.*, 9 (1929), No. 9, pp. 617, 618).—This is a report on the laboratory rearing of the oriental fruit moth (*L. molesta*), undertaken with a view to perfecting methods of propagating the pest under artificial conditions to insure a constant and plentiful supply of larvae for use in rearing its parasites. The experiments were carried out in specially constructed incubators, the temperature of which was held at from 80 to 85° F. Humidity proved to be an important factor, and was varied with the different stages of the insect. The moths reared by the method described live longer and are more active, the preoviposition period is considerably shorter, and they lay more eggs than those from collected material.

Relation of temperature to the growth of the oriental peach moth, I, C. HARUKAWA (*Ber. Ohara Inst. Landw. Forsch.*, 4 (1929), No. 1, pp. 67-94, figs. 4).—These experiments were carried out at variable and at constant temperatures, not lower than 14° C. (57.2° F.) the results obtained being compared. The maximum temperature for the development of the egg was found to be a little higher than those for the larval and pupal stages. Continued exposure to a constant temperature of 33° or higher appears to be injurious to any stage of the insect, and the death rate at 33° sometimes exceeds 70 per cent. The mean value of the accumulated temperatures of the egg stage is 63.4 degree days, that of the growing stage 153.9 degree days, and that of the cocoon period 142.7 degree days.

Life-history, bionomics, and control of *Mylocerus maculosus* Desb. (*Curculionidae: Coleoptera*), K. N. TREHAN (*Agr. Research Inst., Pusa, Bul. 181* (1928), pp. [4]+28, pls. 5, figs. 9).—This is a report of studies of a curculionid enemy of cotton and other plants in Egypt, many of the details of which are presented in tabular form. The adults feed on foliage and the larvae damage cotton roots.

Observations on the control of weevils of the genus *Apion* attacking red clover, J. R. W. JENKINS (*Welsh Jour. Agr.*, 5 (1929), pp. 176-186).—This account deals with three species with flowerhead feeding larvae, namely, *A. apricans*, *A. assimile*, and *A. trifolii*.

Mechanics of digestion of pollen by the adult honey bee and the relation of undigested parts to dysentery of bees, W. WHITCOMB, JR., and H. F. WILSON (*Wisconsin Sta. Research Bul. 92* (1929), pp. 27, figs. 11).—This work is reported upon particularly under the headings of materials and methods, general structure, and the formation of the peritrophic membrane. It was found that when pollen in excess is fed with sugar sirup to bees in winter periods of confinement, dysentery does not necessarily develop. The pollen is taken into the digestive system of the bee usually in suspension, and the disposal was the main object of this study. The mandibles function only as accessory organs in the ingestion of pollen and not as chewing organs as previously supposed, this being shown conclusively by the absence of cracked grains in teased fresh material and in carefully sectioned preparations.

A general study of the histology of the alimentary canal, made particularly of the ventriculus and the peritrophic membrane, has shown that the oesophagus and honey stomach are alike in structure and play little part in the digestion of food. The honey stomach serves only as an organ of temporary storage, the pollen fed to the bees remaining in this stomach usually less than 10 minutes and being rapidly drawn back into the ventriculus by the action of the honey stopper. The spines of the honey stopper strain the pollen from the suspension, showing no crushing or grinding action, little or no sugar sirup passing into the ventriculus until the pollen has all been removed from the honey stomach. Pollen in the ventriculus is at once surrounded by the structureless peritrophic membrane, and digestion at once begins. The pollen mass with its surrounding membrane passes rapidly through the alimentary canal, usually reaching the hind intestine within two and one-half hours after ingestion. The pollen grains at this time are nearly all empty, and in the case of squash pollen collapsed. The peritrophic membrane persists in the hind intestine for a considerable length in many cases, voided feces being largely made up of these food masses and surrounding membranes.

A recording scale for bee hives, D. M. T. MORLAND (*Ann. Appl. Biol.*, 16 (1929), No. 2, pp. 294-298, figs. 4).—This is a description of a recording balance in use in the apiary at the Rothamsted Experimental Station, which gives satisfactory records and is extremely sensitive.

Recommended dates for application of standard hot water treatment to hardy narcissus, H. D. LOCKLIN and G. A. NEWTON (*Western Washington Sta. Bul.* 13-W (1929), pp. 32, figs. 8).—Following a brief introduction, an account is given of the more important pests of daffodils in western Washington at the present time, which include the stem nematode (*Tylenchus dispsaci* Kühn), the narcissus bulb fly, the lesser bulb flies (*Eumerus* spp.), and the bulb mite (*Rhizoglyphus hyacinthi* Boisd.). This is followed by a report of experimental work with the standard hot water treatment of eleven of the more important varieties of narcissus, this being the only method thus far developed which will effectively control all four of these pests in one operation, and the only method known for the complete control of the nematode in the bulbs themselves. This standard hot water treatment consists of soaking the infested bulbs in water heated to a temperature of from 110 to 111.5° F. for a 3-hour period. The bulbs are placed in some container which allows free circulation of the heated water among the bulbs. The 3-hour period is started when the water has attained a temperature of 110° after the bulbs have been immersed. At the end of the required time the bulbs are cooled off immediately by rinsing in cool water. If they are not to be planted at once, the bulbs are spread out to dry thoroughly in a cool, shaded place. The water is contained in a large vat, where it is agitated by a propeller and heated by steam or electricity.

It was found that the eleven varieties can be divided into two general groups, called large-flowered and small-flowered varieties. Charts are given to show the average number of normal flowers for the two groups, early treatment (July 30) giving the largest number per bulb treated for the small-flowered varieties and a late treatment (August 12 to 26) for the large-flowered varieties. Charts are also given which show the average number of normal flowers per bulb treated, average percentage of normal flowers and percentage of increase in weight per bulb, average length of leaves in inches, and the average number of growing points per bulb dug.

It is recognized that the condition of the varieties when treated is all-important and that it is difficult even for the experienced bulb grower to tell exactly when the proper time has arrived for the different classes of narcissus.

Adjustment earlier or later than the average of the dates given should be made to allow for an early or late season, but if given the hot-water process during the 2-week period recommended little injury will result. In any case the bulbs should be treated before the least root action is apparent. It is pointed out that when in doubt it is safer to treat early rather than late, since a too late treatment is liable to cause the more serious damage to the succeeding crop, besides being less effective in nematode control.

ANIMAL PRODUCTION

The Australian saltbush: Its composition and digestibility, W. P. HEADEN (*Colorado Sta. Bul. 345 (1929), pp. 27*).—The study of the value of this plant as a forage crop has been continued (*E. S. R., 21, p. 71*). The plant was grown for 8 successive seasons, 2 of which were on rather poor land, where it made satisfactory growth. Plants 7 ft. in diameter have been produced on better land. The chemical composition appeared to vary with the character of the soil on which the plant was produced. Under Colorado conditions this plant grows close to the ground and is an annual but seeds itself freely.

The green plants were fed to a horse and to three sheep with apparently no ill effects, and the sheep maintained their weight on this ration for three weeks.

Digestion trials were made with three sheep, the results of which are reported in tabular form. During the period of observation these sheep maintained their weight. As a fodder this plant presented no objectionable features, aside from the fact that none of the animals observed made more than very slight gains.

Analyses of commercial feeding stuffs and registrations for 1929, C. S. CATHCART (*New Jersey Stat. Bul. 488 (1929), pp. 104*).—The usual report of the analyses and guaranties for protein, fat, and fiber of 1,234 samples of commercial feeding stuffs collected for official inspection during 1928 (*E. S. R., 60, p. 68*). A list of the principal ingredients in the feed mixture samples as determined by microscopic examination is also included.

[Experiments with beef cattle at the Mississippi Station], C. J. GOODELL (*Mississippi Sta. Rpt. 1927, pp. 16, 17*).—In this study 4 lots of 10 native steers, each averaging approximately 802 lbs. per head, were fed for 93 days on a ration of cottonseed meal and Johnson grass hay, which was supplemented in the respective lots with corn silage, sagrains silage, sorgo silage, and cottonseed hulls. The average daily gains were 2.22, 1.62, 1.82, and 1.91 lbs. per head, respectively. The lot receiving cottonseed hulls produced the cheapest gains. Sorgo silage produced the second least expensive gains, followed by corn silage, while the sagrains silage produced the most expensive gains. The return per steer above feed cost was directly opposite to the cost of gains, being highest in the cottonseed hull lot and lowest in the sagrains silage lot.

[Experiments with beef cattle at the Missouri Station] (*Missouri Sta. Bul. 272 (1929), pp. 31-36, figs. 2*).—The results of three studies are noted.

The relation of sex and age in cattle and the kind, quality, and quantity of carcasses which are produced, E. A. Trowbridge and H. C. Moffett.—In this experiment 7 lots of calves averaging approximately 340 lbs. per head were used. Lot 1 steers and lot 6 heifers were full fed a ration of shelled corn, cottonseed-meal, alfalfa hay, and corn silage for 196 days in dry lot. Lots 2 and 3 steers received a half grain ration and a full roughage ration during the winter. Lot 2 was put on pasture without the grain for 56 days and then full fed for 112 days, while lot 3 was full fed on grass for 168 days. Lots 4 and 5 steers were fed corn silage and alfalfa hay ad libitum during the winter and fed on grass in

the same manner as lots 2 and 3, respectively. Lot 7 heifers were handled in the same manner as lot 3.

The steer calves made somewhat greater and more economical gains than the heifers, but the latter were ready for market 30 days earlier than the former. When marketed at about 700 lbs. there was little difference in the selling price of steers and heifers, but heifers at 900 lbs. sold at a considerable discount as compared to steers. The calves wintered on roughage made more rapid and economical gains on grass than those receiving a half grain ration, but their small winter gains were rather expensive. The calves wintered on a part grain ration and then turned on grass alone made very slight gains during this period. A comparison of native and western steer calves showed the latter to be more economical gainers, but there was no difference in the carcass grading of the two.

Feeding spring beef calves previous to weaning time and ultimately finishing them for market, E. A. Trowbridge and E. M. Jones.—Continuing the work at Sni-A-Bar Farm (E. S. R., 57, p. 459), it has been found that when high-grade native spring calves are to be sold at weaning time it is more profitable to feed them grain while nursing their dams. There was little difference in the returns when the calves were separated from their dams, allowed to nurse twice daily, and fed grain and when the calves were with their dams at all times and fed grain in creeps. Heifer calves running with their dams and fed grain in creeps ate less grain, made smaller gains, but were fatter and sold for a higher price than steer calves.

When steer calves were fed for 6 months after weaning, those fed grain before weaning made slower and less economical gains than calves that had received no grain while nursing or than calves that received grain for only 2 months before weaning. The difference in economy of gains grew smaller as the feeding period lengthened.

Fall calves fed grain while nursing their dams showed a greater net return at weaning time than those fed no grain. On the average the former weighed 115 lbs. more per head than the latter and were fat enough for slaughter at 8 months of age. There was little difference in the rate of gain of the calves fed grain in creeps and those fed grain and alfalfa hay and allowed to nurse twice daily.

Carcass studies, E. A. Trowbridge, A. G. Hogan, M. T. Foster, W. S. Ritchie, and J. A. Cline.—A comparison was made of the carcasses of a fat steer and a fat heifer, approximately 18 months of age before slaughter, fed on a half grain ration for 168 days and on a full grain ration for a similar period. Both carcasses graded as choice. The heifer dressed higher and yielded a higher percentage of hindquarters, loins, and flank. The steer carcass contained 56.1 per cent lean, 29.92 per cent fat, and 13.98 per cent bone, while the corresponding figures for the heifer carcass were 54.68, 32.81, and 12.51 per cent. There was more moisture, ash, and nitrogen in the eye of beef of the steer than in the same cut from the heifer.

The percentage of lean, fat, and bone of a 14-months-old steer carcass was 55.57, 28.09, and 16.34 for a steer full fed for 196 days; 64.32, 14.56, and 21.12 for a steer on a half grain ration for 196 days; and 65.4, 8.25, and 26.35 for a steer fed roughage only for 196 days. The eye of beef of the full fed steer was lowest in moisture and highest in fat, nitrogen, and ash, while the steer fed roughage only was lowest in these respects. Cooking tests of rib roasts showed that the full fed steer lost 8.85 per cent through evaporation and 3.9 per cent through drippings, the half grain fed steer 11.2 and 2.5 per cent, and the roughage fed steer 8.8 and 1.6 per cent. Palatability tests ranked the steers in the order of grain feeding.

[Experiments with sheep at the Nevada Station] (*Nevada Sta. Rpt. 1928*, pp. 22, 23).—The results of three experiments in continuation of those previously reported (*E. S. R.*, 59, p. 865) are noted.

Methods of producing more and better lambs in Nevada range flocks, C. E. Fleming.—A scrubby ram showing some Hampshire blood was bred to 15 good Corriedale ewes and produced 22 lambs, 18 of which were graded in September as culls or lambs needing more finish. In comparison, a purebred Hampshire ram was mated with 32 Corriedale ewes and sired 58 lambs, 57 of which lambs were accepted for market in September. The single lambs sired by the purebred ram gained at the rate of 0.336 lb. per day, while twins gained 0.305 lb. per head daily. The average daily gains of the lambs sired by the scrub ram were 0.298 lb. for singles and 0.296 lb. for twins.

Feeding and finishing range ewes and lambs, C. E. Fleming.—To determine the advisability of finishing aged ewes that had outlived their usefulness on the range, 18 such ewes were fed a ration of alfalfa hay and barley. It cost 17.64 cts. per pound of gain for the feed. This feeding cost makes such a practice unprofitable.

Rations of alfalfa hay and barley and alfalfa hay, barley, and sunflower silage were fed to 2 lots of 20 lambs each. In this test 2.7 lbs. of sunflower silage replaced 1 lb. of alfalfa hay. On this basis, if the yield of alfalfa were 4 tons per acre, sunflowers would have to yield 10.8 tons of silage per acre, which is considerably below the average yield of this section.

Pasturage and silage production for sheep, C. E. Fleming, M. R. Miller, and A. Young.—An area of pasture under continuous grazing yielded between April 25 and August 31 a total of 6,720 sheep grazing units, while an area under a rotation system of grazing yielded 9,600 sheep grazing units. This represents a difference of 30 per cent more forage produced on the rotated pasture.

The effect of various systems of feeding and management on the return made by finewool flocks under southeastern Ohio conditions, D. S. BELL (*Ohio Sta. Spec. Circ. 21 (1929)*, pp. 10, figs. 2).—Over a 3-year period 4 groups of 30 high-grade Delaine Merino ewes each have been maintained under different systems of management. In the summer time all lots were on pasture, but during the winter the lots were all confined to barns with small outside lots adjoining, except lot 1, which was kept outside but allowed access to a barn. Lots 1 and 2 were bred to lamb on pasture during April and May, while lots 3 and 4 were bred to lamb in the barn during February and March. Prior to lambing all the ewes received legume hay and corn stover and, in addition, lot 1 was on pasture, lots 2 and 3 received corn silage, and lot 4 corn silage and 0.5 lb. of mixed grain. After lambing the first 2 lots received no feed except pasture; lot 3 1 lb. of mixed grain per ewe, legume hay, and corn silage; and lot 4 1.5 lbs. of mixed grain, legume hay, and silage. The lambs in lots 1 and 2 received no additional feeds. Lot 3 lambs were given a limited amount of legume hay and grain in creeps until turned on pasture, and lot 4 received all of the mixed grain and hay in creeps that they would eat until turned on pasture.

There was an average lamb crop of 85, 89, 101, and 97 per cent in the respective lots, of which 69, 70, 82, and 85 per cent were raised to weaning time. The average birth weight of lambs was 7.6, 7.1, 7.7, and 8.5 lbs., and the average weight at weaning was 34.7, 34.5, 42.2, and 47 lbs. per head in the respective lots. The wether lambs in feed lot and the young ewes developed for replacements reflected the system of feeding and management under which they were born and reared.

The ewe mortality for the 3 years was 9, 8, 2, and 0 in the respective lots. Culling records show that in flocks 1 and 2 most of the ewes had passed their

period of usefulness at 7 years, while in flock 4 useful ewes were removed that were 10 years old. The value of feeding was also shown by the increased return from wool of the ewes that were liberally fed. Flock 4 made the largest yearly financial return per ewe, even when the prolonged useful life of ewes and the earlier availability of replacement ewes was not considered.

Lamb feeding experiments, D. S. BELL (*Ohio Sta. Spec. Circ. 16* (1929), pp. 8).—Three experiments are noted.

A comparison of western, native mutton, and native fine wool lambs as feeders.—In this test 3 groups of 100 lambs each were fed for 112 days on a ration of shelled corn, linseed oil cake, and alfalfa hay. Lot 1 was made up of western lambs averaging 55.1 lbs. per head, lot 2 of native mutton lambs averaging 55.3 lbs., and lot 3 of native fine wool lambs averaging 52.3 lbs. The average daily gains in the respective lots were 0.345, 0.344, and 0.291 lb. per head. Lot 2 made practically as rapid and more economical gains than lot 1, but because the native lambs were not as uniform they were valued somewhat lower at the end of the feeding period than the western lambs. The native fine wool lambs made slower and more costly gains than either of the other lots, but yielded a heavier fleece.

A comparison of a small and large group of lambs as an experimental unit.—A group of 10 lambs was compared with a group of 100 similar lambs, each lot receiving the same allowance of feed per head daily, to observe the performance of the small group as compared with the large group. The small lot made 4.1 per cent faster gains and required 4.7 per cent less shelled corn, 4 per cent less linseed oil cake, and 5 per cent less alfalfa hay per unit of gain than the large group.

More about skips.—Continuing the study of finishing cull lambs (E. S. R., 57, p. 866), 2 groups of 30 lambs each, averaging 45.5 lbs. per head, were started on a ration of alfalfa hay and a grain mixture of oats, bran, and linseed oil cake for 30 days. During this period 1 group was treated 4 times with copper sulfate solution for stomach worms. After the preliminary feeding both groups were put on a fattening ration of shelled corn, alfalfa hay, linseed oil cake, and salt for 147 days. In the untreated group 4 lambs died during the test, 3 of which deaths were attributed to parasitic infestation, while 3 lambs died in the treated group, none of which deaths were attributed to this cause.

At the close of the feeding period 20 of the 26 lambs in the untreated lot graded as tops, 5 as mediums, and 1 as a cull. Of the 27 lambs in the treated group 25 graded as tops, 1 as medium, and 1 as a cull. These findings indicate the value of special care for native lambs in order to get the most profit from them.

[Experiments with swine at the Mississippi Station] (*Mississippi Sta. Rpt. 1927*, pp. 18, 19).—The results of two experiments are noted.

[*Hogging down corn and soy beans*]. G. S. Templeton and P. G. Bedenbaugh.—A lot of 10 pigs, averaging 124.1 lbs. per head, was turned in a field of corn and Mammoth Yellow soybeans on September 21 for a 28-day period. During this time they gained an average of 46.3 lbs. per head. They were then turned on corn and Laredo soybeans for another 28 days, during which time they gained an average of 32.4 lbs. per head. A second lot of 10 head, averaging 49.3 lbs. each, was turned on corn and Mammoth Yellow soybeans on the initial date and allowed to remain for 56 days, during which time the pigs gained an average of 54.9 lbs. per head. This feeding was followed by a 69-day period on corn and Laredo soybeans, and the pigs gained on the average 74.7 lbs. per head. A third lot of 7 pigs, averaging 51.3 lbs. per head, gained 24.1 lbs. per head during a 28-day period on corn and Mammoth Yellow soybeans and followed this with a

gain of 108.3 lbs. per head during a 96-day period on corn and Laredo soybeans. The pigs were all fed a mineral mixture.

A measured area yielded 44.7 bu. of corn and 6.2 bu. of Mammoth Yellow beans, and on this area it required 394 lbs. of corn and 49 lbs. of beans per 100 lbs. of gain. This variety of beans was very palatable, and considerable corn was left in the field. It was impossible to secure yields on Laredo beans because the plants were so matted in the corn rows. The Laredo variety was not nearly so palatable as the Mammoth Yellow variety.

Marine tankage v. digester tankage supplementing corn in finishing hogs for market, G. S. Templeton.—Marine tankage, a by-product of the fish industry, was compared with digester tankage using 2 lots of 16 pigs each, averaging 68.5 lbs. per head. Corn and digester tankage were fed in lot 1 and corn and marine tankage in lot 2. The average daily gains during the 101-day feeding period were 1.58 and 1.34 lbs. per head. The feed consumed per 100 lbs. of gain was 352 lbs. of corn and 20.9 lbs. of tankage in lot 1 and 389 lbs. of corn and 25.2 lbs. of tankage in lot 2.

[Experiments with swine at the Missouri Station] (*Missouri Sta. Bul.* 272 (1929), pp. 37-40).—The results of two experiments are noted.

Rations for pigs at weaning time, L. A. Weaver.—Continuing these studies (*E. S. R.*, 58, p. 465), the addition of alfalfa meal to the corn and tankage ration increased the rate and economy of gains, 11.06 lbs. of alfalfa meal replacing 31.97 lbs. of corn and 4.26 lbs. of tankage. Adding small amounts of cottonseed meal or linseed meal and alfalfa meal increased slightly the rate of gain and decreased the feed required per unit of gain as compared to tankage alone, but large amounts of cottonseed meal had the opposite effect. Corn and tankage produced more rapid and economical gains than a mixture containing 25 per cent of protein, the latter supplement requiring about twice as much feed to supplement corn as when tankage was used.

Calcium requirements of breeding swine, A. G. Hogan and L. E. Casida.—In this work 6 groups of sows were used to study the calcium requirements, 1 group receiving a check ration containing 0.98 per cent of calcium. Calcium carbonate was added to a basal ration in 3 lots in such amounts that the calcium content amounted to 0.19, 0.25, and 0.75 per cent. Tricalcium phosphate was fed in another lot to supply 0.74 per cent of calcium, and bone ash supplied 0.89 per cent of calcium in the last lot. The animals were given distilled water to drink and kept on board floors to control the calcium intake.

All of the animals grew normally, and there were no obvious symptoms of calcium deficiency. The sows receiving bone ash farrowed normal-appearing pigs and secreted a normal amount of milk, but all of the pigs died within a few days. There were 7 sows in the low-calcium lots, and only 4 of these conceived, 1 of which died at farrowing time, and another became paralyzed. These sows farrowed a high proportion of dead pigs. There was a uniform failure of all sows during the year to eat enough feed. They lost weight, their milk flow was scanty, and the pigs did not grow well.

[Swine feeding experiments at the Newlands, Nev., Field Station], E. W. KNIGHT (*U. S. Dept. Agr. Circ.* 69 (1929), pp. 21-27, fig. 1).—During the years 1924, 1926, and 1927 feeding tests were conducted with swine to determine the most economical system of fattening pigs under Nevada conditions. In each trial the pigs were placed on experiment at weaning time and fed either 1 or 2 per cent rolled barley. Skim milk was fed in some of the lots at the rate of either 5, 10, or 20 per cent. Some of the lots were on alfalfa pasture, and others were fed alfalfa hay in dry lot. In the first 2 tests the pigs were fed this ration until they weighed about 100 lbs. per head, when they were allowed

access to rolled barley in self-feeders. In the third test the pigs were carried to 140 to 150 lbs. before being placed on self-feeders. The fattening period was continued until the pigs reached a final weight of between 175 and 200 lbs.

Skim milk had a greater feeding value when fed with alfalfa hay in dry lot than when fed on alfalfa pasture. It was found that when pork is worth more than 8 cts. per pound and barley is worth 2 cts. per pound it is good practice to increase the grain ration and to keep the skim milk allowance at 5 or 10 per cent. When the price of pork decreases the grain ration should be decreased and the amount of skim milk fed increased. When the price of pork reaches 12 cts. per pound pigs should be put on self-feeders as soon after weaning as possible.

Swine feeding experiments with fall pigs (*Ohio Sta. Spec. Circ. 17 (1929), pp. 14*).—The results of several experiments are noted.

Supplements to corn for winter feeding, W. L. Robison (pp. 3-5).—To study the value of various supplements to corn 6 lots of 8 pigs each, averaging approximately 54.5 lbs. per head, were fed to an average final weight of 191 lbs. on a basal ration of corn. In addition the respective lots received fish meal; tankage; tankage, linseed meal, and ground alfalfa; tankage, linseed meal, and ground alfalfa; dry rendered tankage; and dry rendered tankage, linseed meal, and ground alfalfa. Salt was fed to lots 1 and 3 and a mineral mixture of salt, limestone, iron oxide, and potassium iodide to the other lots.

Due to an outbreak of swine plague the results of this work serve only as an indication of the value of the various feeds. The average daily gains were 1.11, 0.99, 1.04, 1.08, 0.9, and 1.18 lbs. per head in the respective lots. The ration fed in lot 1 produced the most economical gains, but only slightly more so than lot 6. Lot 2 was the least economical lot in the test, but when linseed meal and ground alfalfa was added to such a ration the rate and economy of gains were materially increased. The ration fed lot 3 was not as profitable as that fed lot 4, indicating that the supplemental minerals were more valuable than salt. Dry rendered tankage was more palatable than digester tankage, and pigs receiving it required less feed per unit of gain.

Grinding oats for pigs, W. L. Robison (pp. 6, 7).—Continuing the study of the value of oats for pigs (*E. S. R., 60, p. 171*), 5 lots of 8 pigs each, averaging approximately 54 lbs. per head, were fed a basal ration of tankage, ground alfalfa, and minerals. In addition the respective lots received whole oats, ground oats, ground corn and whole oats, ground corn and ground oats, and ground corn. The average daily gains were 0.66, 0.63, 1.15, 0.98, and 1.05 lbs. per head, respectively. Grinding when oats constituted the entire grain ration reduced the feed required per unit of gain, but the reduction was not enough to pay for the cost of grinding. When fed with ground corn, whole oats produced more rapid and economical gains than ground oats. Oats either ground or whole as a complete substitute for corn was not economical, but a limited amount of whole oats in a ration of corn, tankage, ground alfalfa, and minerals increased the rate and economy of gains.

Additions to corn, tankage, and minerals for pigs in dry lot, W. L. Robison (pp. 8-10).—In this study the inclusion of linseed meal and ground alfalfa enabled 7 pigs averaging 57 lbs. at the start to reach a weight of 250 lbs. 17 days earlier and reduced the feed required per 100 lbs. of gain by 16.5 lbs. as compared to a similar lot on a ration of corn, tankage, and minerals. Linseed meal and tankage in this test did not prove superior to tankage alone for supplementing corn and minerals. A mineral mixture of salt, limestone, and iron oxide proved to be effective for use either with corn and tankage or corn and the trio mixture. Rice polish was found to be practically as efficient as linseed

meal and ground alfalfa in the trio supplement. Hulled oats produced larger gains and required somewhat less feed per unit of gain, but due to the high cost were not as economical as linseed meal. Cottonseed meal was practically equal to linseed meal as to cost and feed required per unit of gain, but the rate of gain was lower when cottonseed meal was fed.

Minerals for feeding with corn, tankage, and linseed meal to pigs in dry lot, W. L. Robison (pp. 11, 12).—Pigs, averaging approximately 48 lbs., were divided into 5 lots of 7 pigs each and fed to an average final weight of 217 lbs. per head. Corn, tankage, and linseed meal were fed in all lots and in addition lot 5 received ground alfalfa. The minerals fed in the respective lots were salt; salt and limestone, 20:80; salt, limestone, and raw bone meal, 20:40:40; salt, limestone, and iron oxide, 19.4:77.6:3; and salt. The average daily gains in the respective lots were 1.32, 1.2, 1.19, 1.32, and 1.25 lbs. per head. The addition of limestone or limestone and raw bone meal did not improve either the rate or economy of gains, but the combination used in lot 4 made as rapid and more economical gains than the ration fed lot 1. The salt and ground alfalfa fed in lot 5, while not producing as rapid gains, did produce more economical gains than the ration fed lot 1.

Flaxseed for fattening pigs, W. L. Robison and L. E. Thatcher (pp. 13, 14).—To determine the feeding value of flaxseed 2 lots of 5 pigs each, averaging approximately 98 lbs. per head, were fed for 112 days on a basal ration of ground barley, tankage, ground alfalfa, and minerals. Lot 1 received ground flaxseed in the proportion of 7.2 per cent to 92.8 per cent of the barley, while lot 2 received enough linseed meal to secure an equivalent amount of protein as contained in the ground flaxseed. Lot 1 gained at the rate of 1.13 lbs. and lot 2 1.03 lbs. per head per day. The feed required per unit of gain was lower in lot 1 than in lot 2. Although the flaxseed contained a relatively high percentage of oil, no difficulty from scouring was encountered.

[*Mule feeding experiments*], G. S. TEMPLETON (*Mississippi Sta. Rpt. 1927*, pp. 15, 16).—In continuing this work (E. S. R., 59, p. 164), the results obtained indicate that 11 lbs. of slightly damaged soybean hay were not equal to 12 lbs. of No. 1 Johnson grass hay in feeding value. Stall-fed mules lost an average of 15 lbs. per head during the 2 feeding periods of 5 months each, while their team mates that were lot-fed gained an average of 97 lbs. during the same period. The lot-fed mules consumed an average of 16 lbs. of ear corn and 11.4 lbs. of Johnson grass hay per 1,000 lbs. of live weight per day. There was no noticeable difference in the time required for feeding under the 2 methods, in the general health of the mules, or in their ability to do their work.

[*Poultry studies at the Mississippi Station*], E. P. CLAYTON (*Mississippi Sta. Rpt. 1927*, pp. 34, 35, 36, 37).—Further results of studies previously noted (E. S. R., 53, p. 67) are reported.

Four winter months' egg laying as a guide to yearly production.—On the basis of their production from November to February, inclusive, 60 White Leghorn pullets were divided into 4 lots. Group 1 contained those birds laying 60 or more eggs during this period, group 2 those laying between 40 and 60 eggs, group 3 those laying between 20 and 40 eggs, and group 4 those laying less than 20 eggs. Based on previous work the estimated production for these groups was 259, 176, 105, and 59 eggs per bird in the respective lots, but the actual production was 186, 148, 108, and 160 eggs per bird.

A study in various proteins alone and in combination as egg producers.—Seven pens of White Leghorns were fed a standard commercial grain and mash to which was added various protein feeds. A 3 years' average production per bird was 114 eggs in a lot receiving beef scrap and cottonseed meal, 109 eggs

when fed beef scrap, 99 eggs with shrimp meal, 79 eggs with cottonseed meal and 2 per cent ground lime, 120 eggs with beef scrap and 2 per cent of lime, 105 eggs with shrimp meal and 2 per cent of lime, and 93 eggs when no additional protein was fed.

Computing cost and growth of chickens from hatching to ten weeks or more of age.—Growing 345 Rhode Island Red chicks to 10 weeks of age cost 43.2 cts. per head, and at this time they weighed 25 oz. Growing 165 White Leghorn chicks to 12 weeks of age cost 40.2 cts. per head, and they weighed 23.2 oz. at the end of this period.

Comparing pullets with and without artificial lights for fall and winter egg production.—Artificial lighting of 500 pullets during the period from November to March, inclusive, showed a profit above feeding costs of \$291.90 as compared with a profit of \$231.93 for 500 pullets and hens without artificial light during this period. The pullets in the lighted lot returned the greatest margin over the unlighted lot during the month of January, but during November and March the unlighted lot showed a greater profit than the lighted lot.

[*Experiments with poultry at the Missouri Station*] (*Missouri Sta. Bul.* 272 (1929), pp. 17-19, 77-81, figs. 2).—Results of several experiments are reported.

New rations for chicks, A. G. Hogan and C. L. Shrewsbury.—When wheat replaced corn in a ration for chicks the rate of growth was materially increased. Chicks were also found to compare favorably with other animals in economy of gains, requiring approximately 3 lbs. of feed to produce a 1-lb. bird, 8 lbs. for a 2-lb. bird, and 13.5 lbs. for a 3-lb. bird.

Supplementing synthetic rations with Osborne-Wakeman vitamin B concentrate, with Minot-Murphy extract prepared from fresh liver, and with skim milk, appeared at times to make successful rations, but usually resulted later in nutritional disturbances. Vitamin D-deficient rations produced chicks below normal in bone ash and inorganic phosphorus of the blood. Vitamin B-low rations also had an adverse effect upon bone ash, while in acute attacks of polyneuritis, due to vitamin B deficiency, there was a marked increase in the glucose of the blood, which, however, remained at a normal level until after the crisis was reached.

Nutritional requirements of poultry, H. L. Kempster and E. M. Funk.—Continuing this study (*E. S. R.*, 58, p. 466) with 6 lots of chicks, it was found that the lot receiving no vitamin D weighed only a little more than half as much as the other lots at 9 weeks of age. Crooked breastbones and long curled toes were among the symptoms of lack of mineral metabolism. Direct sunlight proved to be the most satisfactory supplement used, but cod-liver oil, ultra-violet light, and eggs and milk were also satisfactory.

The effect of feeding cod-liver oil on egg production, H. L. Kempster.—A lot of White Leghorn hens laid 98.7 eggs per head from November 1 to May 31 when housed in a muslin-front house, allowed range during the day, and fed cod-liver oil, while a similar lot of birds handled in the same manner except that they received no cod-liver oil laid 95.5 eggs. A lot of Anconas kept behind glass and fed cod-liver oil laid 89.3 eggs, while another lot fed no cod-liver oil laid 60.8 eggs. Brown Leghorns kept behind glass supplemented with muslin frames and fed cod-liver oil laid 92.6 eggs, while a lot fed no cod-liver oil laid 62 eggs. There was little advantage in feeding cod-liver oil to the Anconas and Brown Leghorns for winter production, the difference being only 1.3 and 4.1 eggs, respectively, from November 1 to February 29.

Value of cottonseed meal, ground soybeans, soybean meal, tankage meat scrap, and dried buttermilk in rations for egg production, H. L. Kempster.—The same basal mash and grain ration was fed to 7 lots of hens from November 1 to

September 30. In addition the respective pens received cottonseed meal 30 per cent and rock phosphate 8, cottonseed meal 30 and bone meal 4, ground soybeans 30 and bone meal 4, soybean meal 30 and bone meal 4, tankage 20, meat scrap 20, and dried buttermilk 30. All of the lots received 1 per cent of salt. The average egg production was 125, 130, 113, 132, 125, 130, and 140 eggs per bird in the respective lots.

The effect of the time pullets start laying on their egg production, H. L. Kempster.—A study of the records of 264 general-purpose hens indicated no disadvantage in having them start to lay at an early date. It was found that the value of the eggs produced was greatest for the birds beginning to lay in September and gradually decreased each month thereafter.

Weights of offspring of hens as compared with offspring of pullets, H. L. Kempster.—There was no appreciable difference in the weights of female chicks produced by hens and those produced by pullets when weighed in December.

Using artificial lights to stimulate winter egg production, H. L. Kempster and R. R. Parks.—From October 13 to April 30 birds in an artificially lighted house laid 87.2 eggs while a similar lot in a house unlighted laid 92.3 eggs per bird. A cold spell in December caused an abrupt stop in egg production in the lighted lot, but the effect was not so noticeable in the unlighted lot. The value of the eggs produced was the same in both lots, while the lighted lot consumed 10 per cent more feed.

The feed purchasing power of the eggs laid by a hen, H. L. Kempster.—In this study the author has calculated by years from 1910 to 1927 how much feed a hen's eggs would purchase, based on an average production of 122 eggs per year. The price of feed was taken as the average price of a mixture of 5 lbs. of corn, 3 lbs. of oats, and 3 lbs. of wheat. The peak of the purchasing power of eggs was reached in 1921.

Results of poultry feeding experiments, G. L. STEVENSON (*South Dakota Sta. Bul. 242* (1929), pp. 8).—The popular application of facts obtained in experimental studies (E. S. R., 56, p. 660; 61, p. 62) is presented in this publication, partly to show the bad effects of feeding unbalanced rations to poultry and to aid in preparing balanced rations, using farm-produced feeds in as large a measure as possible.

New Jersey poultry rations, C. S. PLATT (*New Jersey Sta. Hints to Poultrymen*, 17 (1929), No. 11, pp. 4).—The feed mixtures and the methods of feeding them to poultry from baby chicks to laying hens as recommended by the New Jersey Experiment Stations are presented.

Calcium metabolism in the laying hen.—III, Calcium carbonate and hatchability, G. D. BUCKNER, J. H. MARTIN, and A. M. PETER (*Kentucky Sta. Bul. 291* (1929), pp. 23).—Continuing this series of studies (E. S. R., 52, p. 75), the essential details of which have been previously noted (E. S. R., 55, p. 888), it has been shown that when calcium carbonate was deficient in a ration consisting of yellow corn, wheat, and buttermilk ad libitum, and green feed twice a week, the hatchability of the fertile eggs gradually diminished, finally becoming zero. Such feeding resulted in an increase in the percentage of infertile eggs and a decrease in the size and number of eggs laid, and also in the weight of the eggshells. The chicks hatched from eggs produced on a calcium-deficient ration weighed less than those from a ration containing a sufficient supply of calcium, and the ratio of the weight of the moisture-free carcass of the former chicks to the original contents of the eggs from which they were hatched was less than in the case of chicks produced under the latter conditions.

Limitations as to sunlight requirements of hens, W. P. WHEELER (*New York State Sta. Bul. 572* (1929), pp. 14).—Over a period of 4 years tests were

conducted to show the importance of the light factor in profitable egg production and its influence on hatchability. The first year 2 lots of pullets and the other 3 years 3 lots were handled and fed in the same manner, being confined behind ordinary window glass during the winter months. After the winter period some lots were allowed access to unfiltered sunlight on all fair days. Other lots were continued behind the window glass, others exposed to reflected sunlight, and still others exposed at varying intervals on fair days after the winter confinement period.

On an ordinary standard ration supplemented with legumes, hens maintained a good production during the winter months. However, when continued on this ration and receiving only light filtered through window glass the hens began to show nutritional disturbances, and the production of hatchable eggs decreased rapidly. When exposed to direct sunlight at 10-day or even 20-day intervals after the winter confinement a good rate of egg production was maintained, and a large percentage of strong chicks were hatched from the eggs. The same was true of hens allowed access to reflected sunlight. The hens allowed access to direct sunlight on all fair days had a high rate of production, and the percentage of hatchable eggs was also good.

Some inherited causes of low egg production, C. S. PLATT (*New Jersey Sta. Hints to Poultrymen*, 17 (1929), No. 12, pp. 4).—Some of the fundamental factors that should be understood before a poultry-breeding program is put in operation are discussed in this publication.

Final report first Panhandle egg laying contest, November 1, 1926—October 26, 1927, O. S. WILLHAM ([Oklahoma] Panhandle Sta., Panhandle Bul. 9 (1929), pp. 18, fig. 1).—This is the final report of the first Panhandle egg-laying contest held at Goodwell, Okla., beginning November 1, 1926, and closing October 26, 1927.

DAIRY FARMING—DAIRYING

[Experiments with dairy cattle at the Mississippi Station], J. S. MOORE (*Mississippi Sta. Rpt. 1927*, pp. 23-25).—The results of several experiments are noted.

Pasture for dairy cows.—Continuing the pasture studies (E. S. R., 58, p. 68). 3 lots of 4 cows each were used. Two lots were on pasture supplemented with grain for 8 weeks and then full fed in dry lot for a similar period. The third lot was on pasture continuously. The cows were able to pay \$7 rent per month for 6 months on good pasture when grain was valued at \$40 per ton and hay at \$10 per ton.

Losses in the manure of grain in sargrain silage when fed to dairy cows.—A lot of 3 cows was fed 25 lbs. of sargrain silage each for 9 days. The feces were collected the last 2 days of the period and the seeds of the sargrain separated, weighed, and analyzed. The average loss of grain by the cows in the 2 days was 1.8 lbs. The seed in the silage contained 59.2 per cent of the total dry matter, 70.3 per cent of the total protein, and 90.6 per cent of the total nutrients in the silage. The analyses of the whole grains in the feces showed that 15.2 per cent of the dry matter, 19.7 per cent of the protein, and 23.2 per cent of the total nutrients in the silage passed through the digestive tract unused.

Influence of thick and thin planting of sorghum on the quality of silage.—A chemical analysis of silage made from a large-growing variety of sorghum that had been thickly planted showed that it contained 1.49 per cent of protein, 0.95 per cent of fat, and 13.19 per cent of nitrogen-free extract, while the same sorghum planted thin produced a silage containing 1.03 per cent of protein, 0.54 per cent of fat, and 13.87 per cent of nitrogen-free extract.

Feeding sprouted oats to overcome difficult breeding.—Sprouted oats were fed to 2 Jersey and 2 Ayrshire heifers with which difficulty in breeding had been encountered. One Jersey had been bred 7 times before the test started but only once after feeding sprouted oats. The other Jersey was bred 22 times before the test, kept on sprouted oats for 129 days, and bred 7 times but failed to conceive. One Ayrshire was bred 8 times before starting the test and 6 times during the 129-day feeding period and still failed to get with calf. The other Ayrshire was bred 5 times before and once after the beginning of sprouted oats feeding.

Yield of green crops per acre.—In this study the amount of green feed produced per acre was found to vary from 5,760 lbs. of pasture grasses to 29,600 lbs. of oats and hairy vetch per acre.

[Experiments with dairy cattle at the Missouri Station] (*Missouri Sta. Bul.* 272 (1929) pp. 42, 45, 46, 53, 54, 56, 57).—The results of many experiments, some of which are continued (E. S. R., 58, p. 468), are noted.

Normal growth of dairy cattle. A. C. Ragsdale, S. Brody, and E. C. Elting.—Records of growth in weight and 5 linear measurements have been made on 151 male and 135 female calves of the Ayrshire, Guernsey, Holstein, and Jersey breeds. These records show that when the growth of young animals is retarded, it requires considerable time for the animals to mature sufficiently for breeding and that the period of most economical growth is passed over. When bred at a given age, regardless of size, dairy animals come in milk while undersized and lactation still further delays growth. Dairy cattle that make a maximum growth from birth have longer and more economically productive lives than those that have been stunted.

Influence of milking pregnant animals before calving on the physical condition and well-being of the progeny. A. C. Ragsdale, C. W. Weber, and C. W. Turner.—A calf from a heifer milked at regular intervals prior to calving was raised successfully and appeared to be normal at all times. Calves from 2 other heifers similarly treated died on the fifth day and 2½ months after birth, respectively, of *Bacillus coli* infection.

Four cows milked at intervals of 10 days to 2 weeks before calving produced offspring, 1 of which died 10 days after birth from *B. coli* infection, while the other 3 survived and were in apparently good health.

An analysis of the progeny performance of Holstein, Jersey, and Ayrshire sires and dams. W. Gifford and C. W. Turner.—A statistical analysis of the records of daughters of Holstein dams with records showed that there was only 18 lbs. constant increase in yearly production of the daughters per 100 lbs. increase in the dam's production. It was also shown that a unit increase in the yearly production of the dams affected their sons' daughters' production to about the same extent as the same unit increase in the sire's average progeny record influenced his sons' daughters' production.

The productive ability of cows to which proven sires of the Guernsey breed are mated. W. Gifford and C. W. Turner.—No significant correlation was found between the age of proved Guernsey sires that sired daughters after the age of 6 years and the yearly fat production of 2,974 daughters. Daughters sired by mature or older bulls were not superior to those sired at an earlier age. The mean average production of the 1,574 dams with which these bulls were mated at the various ages was approximately the same for all groups.

Initiation of milk secretion in nonpregnant heifers. C. W. Turner, E. C. Elting, and W. Gifford.—The slight changes which occur in the development of the mammary gland of cattle from birth to puberty were observed in the epithelial cells during the recurring heat periods. A noticeable increase in milk secretion

was also observed at each recurring heat period, and the production reached was usually maintained between heat periods. It has been possible to induce a considerable secretion which approached normal milk in appearance and composition in virgin heifers by a hormone isolated from the ripe follicle of the ovary.

Milk secretion during the first pregnancy, C. W. Turner, E. C. Elting, and W. Gifford.—When cows were milked at regular intervals during pregnancy there was no increase in secretion for some time after breeding, but a significant increase at 20 to 40 days before calving. From this time on the yield of milk gradually increased until from 10 to 20 lbs. per day was being produced at calving time.

The quantity of milk present in the udder at milking time, C. W. Turner, E. C. Elting, and W. Gifford.—Three cows were given injections of pituitary extract 30 minutes before killing and immediately after killing the udders were removed and milked. At a corresponding milking time previous to killing, the cows had produced 10.5, 15, and 12.7 lbs. of milk, while 10.7, 10.5, and 8.3 lbs. of milk was removed from the respective udders after death. This extract was thus not successful for getting large post-mortem yields of milk.

The effect of pituitary on milk yield, C. W. Turner, E. C. Elting, and W. Gifford.—Immediately after the regular evening milking 2, 4, and 6 cc. of an extract of the posterior lobe of the pituitary body was injected and the cows milked 30 minutes later. With the respective amounts of extract 233, 504, and 870 cc. of milk was obtained at the second milking. Larger injections did not further increase the yield. An injection of 0.5 cc. per 100 lbs. live weight produced the maximum effect. Increasing amounts decreased the yield at subsequent milkings, and the inhibitory effect of a 10 cc. injection lasted about 9 hours. The only effect of the extract upon the composition of the milk was to increase the fat content.

The relation of conformation and anatomy of the dairy cow to her milk and butterfat producing ability, C. W. Turner, E. C. Elting, and W. Gifford.—A study of the weights and measurements of the carcasses and vital organs of cows of known producing ability showed a close relationship between the depth of chest and the weight of the lungs and heart, but little relationship between the width and length of the chest cavity and the size of these organs.

Stimulating milk secretion, C. W. Turner, E. C. Elting, and W. Gifford.—When fed ground placenta a dry cow increased her milk secretion from 0.3 lb. to 2.1 lbs. per day. When a larger amount was fed 3 days later no appreciable change in production occurred. However, when 7 lbs. of placenta was fed 9 days later, milk secretion increased 2 days after the feeding to 4 lbs. per day.

Physiology of the milking process, C. W. Turner, E. C. Elting, and W. Gifford.—In this study the authors have found that in the interval between milkings milk is formed in the epithelial cells of the alveoli at a rapid rate. When filled the cells discharge the milk into the lumen of the alveoli. At first the cells are low and cubical in form but gradually elongate as they become filled. When the milk is discharged the cells flatten out and are ready for another period of secretion. When the capillaries, milk ducts, and cistern become filled with milk the pressure in the udder increases and the cells have more difficulty in discharging their contents. At this time only the constituents of milk that are soluble in water pass out, leaving the fat, casein, and possibly other constituents remaining in the cell. With milking the cells gradually discharge their contents so that the last milk drawn is richer in fat than the first.

During the milking process a nervous reflex causes a contraction of the muscle elements of the gland, forcing the contents of the lumen and fine

capillaries into the larger ducts. Here smooth muscles arranged longitudinally contract and force the milk into the cistern. At this time extremely rapid milking promotes complete milking. Later the muscles relax and a part of the milk not yet removed is drawn up in the capillary tubes and can not be removed. It is probable that a rather considerable quantity of milk remains in the udder after milking under ordinary conditions.

The size of fat globules in milk. C. W. Turner, E. C. Elting, and W. Gifford.—Microphotographs of over 21,000 fat globules in 75 milk samples have been made. It was found that the mean diameter of 2,727 Jersey fat globules was $3.34\ \mu$ with a standard deviation of $1.33\ \mu$; of 14,853 fat globules of Holstein milk 2.5 and $1.19\ \mu$; and of 3,490 Ayrshire fat globules, 2.34 and $1.16\ \mu$.

Test of the economic efficiency of alfalfa hay as sole ration for dairy cattle and its relation to sterility. F. B. HEADLEY (*Nevada Sta. Rpt. 1928, p. 29*).—Continuing this study (E. S. R., 59, p. 871), the percentage of shy breeders did not vary between the all-hay group and the groups receiving supplementary feeds. Cows have been fed hay alone for 2.5 years with no apparent ill effects. It was found that when the price of butterfat does not exceed 45 cts. per pound and grain sells for more than \$40 per ton the all-hay ration gives the best net return per cow. Calves have been profitably raised to weaning age by eliminating the whole milk in the third week and substituting skim milk and a calf meal.

[*Experiments with dairy products at the Missouri Station*] (*Missouri Sta. Bul. 272 (1929), pp. 43-45, 46, 47*).—The results of several experiments are noted.

The thermal death point of Mycobacterium tuberculosis in colostrum and in milk. A. C. Ragsdale, C. W. Weber, and C. W. Turner.—Samples of colostrum inoculated with approximately 50,000 tubercle bacilli per cubic centimeter were heated to 140° F. for periods of from 1 to 7 minutes and injected into guinea pigs. The resistance of the organism was determined by macroscopic and microscopic post-mortem findings of the pigs. The strain of tubercle bacilli used was from 2 to 3 times as resistant to heat when suspended in colostrum as it was in milk, but the thermal death point was well below 140° for 30 minutes (E. S. R., 58, p. 469).

Chemical composition of precolostrum. A. C. Ragsdale, C. W. Weber, and C. W. Turner.—A viscid, yellowish, honey-like secretion, which rapidly became horny on exposure to air, was obtained from first-calf heifers as early as the fourth month of pregnancy, and cows that had previously calved gave a similar secretion. A chemical analysis of this secretion showed it to contain as high as 18 per cent of globulin and from 7 to 10 per cent of albumin, while the casein content was low. While the milk yield increased rapidly previous to calving, the globulin content of the milk decreased to less than 0.2 per cent at calving time. When cows were milked daily for a period of 10 or more days previous to calving, the composition of the secretion was more like that of normal milk than of colostrum.

The effect of processing ice cream mixtures at different pressures when the milk solids-not-fat content is varied. W. H. E. Reid and E. R. Garrison.—Continuing the study of processing ice cream mixes (E. S. R., 60, p. 368), it was found that homogenization decreased the size of fat globules and caused clumping in mixes containing 9, 10, 11, 12, and 13 per cent of milk solids-not-fat. Increasing the pressure on the first valve of the homogenizer increased the surface tension and viscosity, but viscosity was not always increased when the pressure on the second valve was increased. Increasing the pressure on one or both valves resulted in an easier incorporation of air. An increase in the

milk solids-not-fat reduced the temperature of the ice cream, when drawn from the freezer, resulting in a smoother product that was more resistant to summer temperatures. The ability of ice cream to hold up under summer temperatures was reduced by processing, but the flavor, body, and texture were improved.

Bacteria that survive and grow during the pasteurization of milk and their relation to bacterial counts, P. S. PRICKEIT and R. S. BREED (*New York State Sta. Bul.* 571 (1929), pp. 25, figs. 3).—Concluding this experiment (E. S. R., 60, p. 473), a study of the types of heat-resistant and heat-loving bacteria indicated that the original source of contamination was the dust and dirt that came in contact with the milk at the farm. Although the original numbers were probably small, they increased rapidly under favorable temperature conditions and usually appeared during pasteurization.

Farmers may reduce the number of these bacteria by reducing to a minimum the contamination from feed, hay, and stable dirt, and also by careful observation of the sanitary condition of milk cans and other utensils. For the milk plant it is recommended that to prevent excessive growth of these bacteria clean, dry, sterile cans be returned to the producer, that there be no repasteurization of drainings or drippings from the pasteurizer, bottling equipment, or milk returned from routes, that the length of the pasteurizing run be kept within limits that prevent excessive growth of thermophilic bacteria, that milk be not held for longer than 30 minutes at above 100° F., and that the pasteurizer be flushed and scalded to remove completely all milk cooked on the equipment and also be flushed with hot water just before using. When bottled pasteurized milk was held over night below 45° a reduction was found in the number of bacteria that survived pasteurization.

VETERINARY MEDICINE

[Report of the department of veterinary science at the Missouri Station], J. W. CONNAWAY, R. L. CROUCH, A. W. UREN, and A. J. DURANT (*Missouri Sta. Bul.* 272 (1929), pp. 91-94).—In swine studies a large percentage of the progeny of postive reacting dams and grand dams were found to be susceptible to *Brucella abortus* (Bang) through cohabitation. The transmission of *B. abortus* to a noninfected sow with negative history and a nonreactor to the serological tests took place through association with an infected boar. Two boars developed strong positive reactions to serological tests through association with infected sows. *B. abortus* was transmitted to young sexually mature boars prior to breeding service by exposure to bedding from an infected farrowing pen.

In an agglutination study of 32 strains of *B. abortus* coming from 6 widely separated States, 27 were found to be of bovine and 5 of porcine origin. Sera from 13 animals, 10 reactors, and 3 nonreactors, whose clinical history was known, were used in the experiment. A composite field sample of sera from several positive reactors was also included. The serum dilutions employed ranged from 1-50 to 1-1,000. The variations in the agglutinability of the different antigens were within the normal limits of error, and were no greater than the variations in a group of 20 antigens made from an individual strain. It was found that all the strains of *B. abortus* studied could have been used for practical diagnostic purposes.

Experiments are referred to in which serological tests and clinical observations were continued with two herds of abortion-infected cattle, in which the positive reactors had been treated with three intravenous injections of a 1-200 aqueous solution of acriflavine at intervals of seven days. In a dairy herd in

which 18 cows had been so treated there was no evidence of a permanent loss of infection during a period of nearly two years, although short temporary negative blood phases were observed. In a herd of purebred beef cattle, in which 14 abortion-infected cows were given similar treatment with acriflavine, the results were similar. It is pointed out that the therapeutic and pathological effects of a larger dosage and more prolonged treatment have not been determined.

Reference is made to cecal ablation for the prevention of enterohepatitis (blackhead) in turkeys, reports of which, by Durant, have been noted (E. S. R., 60, p. 876). None of the ablated birds developed evidences of enterohepatitis during periods ranging from 83 to 652 days.

Poisonous range plants, C. E. FLEMING, M. R. MILLER, L. R. VAWTER, and A. YOUNG (*Nevada Sta. Rpt. 1928, pp. 21, 22*).—This is a brief summary of the work that has been conducted at the station with poisonous plants of the range and alkali poisoning, including *Atriplex canescens* noted below.

The hemolytic activity of *Atriplex canescens*, M. R. MILLER (*Jour. Amer. Pharm. Assoc.*, 17 (1928), No. 3, pp. 238-241).—This is a contribution from the Nevada Experiment Station on the shade scale (*A. canescens*), a plant occurring on vast areas of a large portion of the West that has generally been held by stockmen to be of value for browse and forage. The station has demonstrated through feeding experiments that it contains a substance or group of substances that are capable of producing pathological conditions. It has been demonstrated in the laboratory to have the properties of the class of compounds known as saponins. The studies have shown a variation in the hemolytic activity of the plant with the season, being least toxic in late summer and fall, and increasing to a maximum in early spring. There has also been found to be a decrease in its toxicity during June and July.

Arrow grass (*Triglochin maritima*) as a stock-poisoning plant, C. D. MARSH, A. B. CLAWSON, and G. C. ROE (*U. S. Dept. Agr., Tech. Bul. 113* (1929), pp. 15, figs. 4).—Following a brief review of the literature, a description is given of arrow grass, followed by a report of experimental work conducted in Utah at the Salina Experiment Station and at Goshen during the summers of 1925 and 1926.

This grass is widely distributed, growing in alkaline places in Europe, Asia, northern Africa, and North America, and has toxic properties caused by the production of hydrocyanic acid. Considerable losses have been caused by it, cattle being somewhat more susceptible to its effects than are sheep. In the presence of other forage, cattle may eat considerable arrow grass with no harm, but when grazing on poor pasture they eat enough in a short time to cause intoxication or death. The sickness comes on very quickly, lasts a comparatively short time, and in cases of recovery has no permanent effect. The air-dried plant used in the experimental work was found to have gradually lost most of its toxicity, and there appears to be no danger from hay containing arrow grass.

Sleepy grass (*Stipa vaseyi*) as a stock-poisoning plant, C. D. MARSH and A. B. CLAWSON (*U. S. Dept. Agr., Tech. Bul. 114* (1929), pp. 20, figs. 5).—Following a brief historical résumé of the literature, experimental work conducted with dry material at the Salina Experiment Station, Salina, Utah, and with the green plant at Cloudcroft, N. Mex., is reported, the details being given in tabular form. This grass, which is widely distributed over the southwestern part of the United States, has been known in some localities in New Mexico as "sleepy grass" because of its reputed effect on livestock. It has been shown by experimental feedings to produce a narcotic effect on horses, and the dosage has been determined. While profound slumber may be produced, it does not

cause death. Cattle showed no effect from the plant, and sheep, although slightly affected, did not show typical symptoms of drowsiness. Definite cases of its poisoning have been reported from only two general localities, namely, the Sacramento and the Sierra Blanca Mountains in Otero and Lincoln Counties, New Mexico.

A list is given of 22 references to the literature.

Trembles, C D MARSH (*U. S. Dept Agr., Farmers' Bul. 1593 (1929), pp. II+10, figs. 7*).—This is a practical summary of information on a disease of cattle caused by certain plants fed upon, particularly white snakeroot and rayless goldenrod.

The differentiation of the species of the genus *Brucella*, I. F. HUDDLESON (*Michigan Sta. Tech. Bul. 100 (1929), pp. 16, fig. 1*).—Following a review of the literature, 34 references to which are listed, the author reports upon procedures that may be employed in differentiating the several forms of *Brucella*, including the hydrogen sulfide method and the bacteriostatic action of dyes. A total of 310 strains of the genus were studied to determine the accuracy of a rapid and simple method for distinguishing the main species to which they belong, and it has been found that by taking advantage of their behavior toward dyes in suitable dilutions in a medium all strains fall into one or the other of three groups or species.

"Those strains, which are slightly, if at all, inhibited in their growth on beef liver infusion agar containing thionin in a 1-25,000 or 1-50,000 dilution or containing basic fuchsin in a 1-25,000 or 1-50,000 dilution belong to the *B. melitensis* species. Those strains which grow on the thionin medium but fail to grow on the basic fuchsin medium belong to the *B. suis* or porcine species. Those strains which grow on the basic fuchsin medium but fail to grow on the thionin medium belong to the *B. abortus* (Bang) species. By employing a medium containing thionin in the dilution mentioned and one containing basic fuchsin in the proper dilution the three known species of *Brucella* can be distinguished from one another. On the basis of the present existing evidence, it is proposed that the genus *Brucella* be divided into three main species, namely, *B. abortus* (Bang), *B. suis* (Traum), and *B. melitensis* (Bruce)."

A determination of the non-specific agglutinin content of normal bovine sera, and its bearing on the interpretation of the agglutination test for bovine contagious abortion, A. W. HOLTUM (*Jour. Compar. Path. and Ther., 42 (1929), No. 1, pp. 33-39*).—The fact that the lowest titer of serum which can be considered to give a specific diagnostic reaction in bovine abortion has never been generally agreed upon and laboratory workers are much at variance in their opinions regarding it led to the work here reported.

The sera from 7 infection-free herds, comprising 334 head of cattle, obtained on the island of Jersey, were subjected to agglutination tests. As a preliminary to the work, 18 strains of *Brucella abortus* which had been subcultured at monthly intervals for varying periods were submitted to agglutination tests, a known positive serum being used, in order to select a strain of high agglutinability against which the herd sera could be tested. The technic employed in the agglutination test was the same as that described in the previous account (*E. S. R., 60, p. 271*).

Of the sera tested only 1 showed a water-clear agglutination at a dilution of 1 in 10 and only 5 sera showed "almost-clear" reactions at the same dilution. None of the sera showed even a trace of agglutination above 1 in 50 dilution. The results are thought to prove that the nonspecific agglutinin content of normal bovine sera is a low one, so low in fact that water-clear

agglutination at 1 in 15 is probably indicative of the presence of specific agglutinins.

The filterable virus of tuberculosis, T. M. DOYLE, A. B. ORE, and H. S. PURCHASE (*Jour. Compar. Path. and Ther.*, 42 (1929), No. 2, pp. 127-132).—The authors tested six specimens of milk and three of blood obtained from cows affected with tuberculosis by guinea pig inoculation for the presence of the filterable virus. Acid-fast bacilli indistinguishable from tubercle bacilli were found in gland smears of guinea pigs inoculated with filtrate of each specimen of milk and blood. In one instance acid-fast bacilli indistinguishable from tubercle bacilli were found in gland smears of a guinea pig inoculated with the filtrate of milk from the apparently healthy udder of a cow affected with pulmonary tuberculosis.

Some experiments on tuberculin testing by the subcutaneous and intradermal methods, and observations as to their comparative values on young cattle and dairy cows, respectively, T. PARKER (*Jour. Compar. Path. and Ther.*, 42 (1929), Nos. 1, pp. 49-57; 2, pp. 109-117).—The author concludes that a positive reaction by either the subcutaneous or intradermal method of testing may be accepted as certain evidence that the animal in question is tuberculous in some degree. "A so-called doubtful but definite reaction by the subcutaneous method should, provisionally, be regarded as positive. The ophthalmic test, although generally recognized as a subsidiary test, may occasionally prove the deciding factor when in combination with either of the other two methods. For testing quite young cattle (from a few months to 2 or 3 years of age) for the presence of tuberculosis, either the subcutaneous or the intradermal method may be considered as highly satisfactory. For testing adult cattle, such as dairy cows, the intradermal method is more reliable than the subcutaneous method. The test by either method, however, is not entirely satisfactory because negative results, whether obtained alone or in combination with the ophthalmic method, can not be relied upon as being accurate, for, on slaughter, tuberculous lesions may be found in one or more of the animals in question."

Hemorrhagic disease in cattle, E. RECORDS and L. R. VAWTER (*Nevada Sta. Rpt.* 1928, pp. 24, 25).—A report upon the progress of work with this disease (E. S. R., 59, p. 879). Reference is made to field tests conducted with 2,715 privately owned cattle and 170 privately owned sheep, in which 27 groups of cattle were represented in an area comprising 2 counties in Nevada and 1 adjacent California county. It was found that vaccination stopped the sheep losses entirely after the lapse of 1 week. Deaths among the vaccinated cattle occurred between 5 and 6 months after they were vaccinated while on winter pasture on a heavily infected area. None of the suspect cases among the vaccinated developed typical symptoms of red water disease. Clinical and necropsy examinations confirmed the diagnosis in all cases. One dairy herd of 74 head lost 4 head of controls in the 60 days subsequent to vaccination. Losses started in vaccinated animals approximately 6 months after the vaccination in 1 herd only. It is pointed out that immunity is not presumed to endure longer than 6 months.

A living nontoxic vaccine is being developed.

A contribution to the knowledge of pyaemic forms of infection in sheep, H. MAGNUSSON (*Jour. Compar. Path. and Ther.*, 42 (1929), No. 2, pp. 73-91, figs. 4).—The author, director of the bacteriological laboratory of the Agricultural Society, Malmö, Sweden, has met with a pyemic disease, localized in the subcutaneous soft parts of the head and the associated lymphatic glands, in four different flocks of sheep. In certain cases abscesses have also occurred

in the lungs, liver, kidneys, and the udder. These abscesses contained a plastic, viscous pus, in which were present small numbers of Gram-negative rods in pure culture. These were identical with *Bacterium parvifaciens* Christiansen. In none of the cases could the Preisz-Nocard bacillus, *B. pyogenes ovis* (Carré and Descazeaux), or Spray's diplococcus (E. S. R., 49, p. 786) be isolated or shown.

The mercuric chloride test for camel trypanosomiasis, S. C. J. BENNETT (*Jour. Compar. Path. and Ther.*, 42 (1929), No. 2, pp. 118-126).—In continuation of earlier studies (E. S. R., 69, p. 803), the author has confirmed the view that the mercuric chloride test is superior in every way to the formol-gel test for the diagnosis of trypanosomiasis in camels.

Congenital loco in chicks, F. L. KNOWLTON (*Oregon Sta. Bul.* 253 (1929), pp. 15, figs. 2).—This is a report of studies of a distinctive type of crippled chicks, first noted in the station hatching work in 1924, which has been named congenital loco. The apparent lack of control of the muscles of the neck, resulting in the chick not being able to stand or eat normally, is said to be the principal symptom of the affection. All chicks showing such symptoms are said to have died on or before the ninth day after hatching. While the exact cause of the condition is not known, the observations indicate a possible impairment of the structures controlling equilibrium. Reports of the occurrence of such symptoms in chicks are said to have been received from 30 States and Provinces. Of 607 chicks coming from carrier parents that were studied, 24.05 per cent showed the symptoms of congenital loco, 25 being the expected percentage. The contamination is thought to have been introduced into the college flock by two males that were received in 1921.

It is pointed out that the affection is of no economic importance to the producer of commercial eggs, but is of great economic importance to the pedigree breeder, who must employ a breeding test to eliminate it from his flocks.

AGRICULTURAL ENGINEERING

[Agricultural engineering investigations at the Missouri Station], J. C. WOOLEY ET AL. (*Missouri Sta. Bul.* 272 (1929), pp. 29-31).—Data from 40 farms on the cost of using electricity for feed grinding, machine milking, cream separating, machine washing, and water pumping are briefly summarized by R. R. Parks and M. M. Jones.

Tests, by Jones and A. H. Graves, of the effect of manuring silt loam soil on plow draft showed no difference in draft from various amounts of manuring. The average draft of wide-bottom plows was found to be considerably less than that of narrow-bottom plows on silt loam soils.

A continuation of the tests, by Jones, of fence post treatments (E. S. R., 58, p. 481) showed that charring the butts of sycamore, red oak, and Kentucky coffee bean posts increased their serviceable life, but had no beneficial effects on the other varieties. Painting with hot carbolineum doubled the life of many of the soft woods. Painting with hot creosote was not effective. In the 14 varieties that have failed to date, the 2-hour double treatment with creosote has increased the serviceable life 2.9 times. The 5-hour double tank treatment of creosote has increased the serviceable life 3 times. For the varieties that have failed to date, the 2-hour treatment was practically as good as the 5-hour treatment.

[Land clearing, soil preparation, and tillage methods], J. H. CHRIST (*Idaho Sta. Bul.* 158 (1928), pp. 15-18, fig. 1).—Methods of clearing cut-over lands in northern Idaho are briefly discussed and practical information given on methods of preparing and tilling the cleared soil.

The control of gullies, R. E. UHLAND and J. C. WOOLEY (*Missouri Sta. Bul.* 271 (1929), pp. 24, figs. 22).—Practical information is given on the causes of gullying in soils and on control measures.

The plowing-in and seeding of gullies is applicable to those of both large and small size, provided the drainage areas are not too large. Straw furnishes a cheap and effective means for stopping the small washes which often occur in wheat fields, corn fields, and even in pastures and meadows, especially on moderate slopes where the drainage area is small. One of the most effective yet inexpensive ways of checking small washes in wheat fields, meadows, or pastures is the use of bluegrass sod placed in old burlap fertilizer or feed bags.

It has been found advisable to use a crop rotation which includes a sod crop and which calls for a limited amount of cultivation, and to keep the soil covered with a sod crop, preferably a legume, as much of the time as possible. Organic matter should be incorporated in the soil to increase the water-holding capacity.

Woven wire dams should be used in broad shallow gullies, although concrete triangular-notch dams can be used where a permanent structure is desired.

The relation of runoff to vertical interval of terraces, R. W. BAIRD (*Agr. Engin.*, 10 (1929), No. 6, pp. 188, 189, figs. 5).—Data on run-off from terraces with 4-, 3-, and 2-ft. intervals and grades varying from level to 4 in. per 100 ft. are reported from experiments at the Oklahoma Experiment Station.

The percentage of run-off was consistently higher for the terrace with the 2-ft. vertical interval than for either of the others, but in two cases the run-off was less from the terrace with the 3-ft. interval than from that with the 4-ft. interval. However, these results agree fairly well with the general run-off law that the longer the slope the less will be the run-off from a given area.

The amount of solid material carried varied from 0.469 per cent for the terrace with the 4-ft. interval to 0.416 per cent for the terrace with the 2-ft. interval. The total salts and nitrates carried were in about the same proportion.

In general, the results would seem to indicate that, with terraces of the conventional type with a variable grade and well-opened outlets, the total amount of run-off will increase as the vertical interval is lessened, but the amount of soil carried will be slightly less.

Public Roads, [September, 1929] (*U. S. Dept. Agr., Public Roads*, 10 (1929), No. 7, pp. 117-136+ [2], figs. 14).—This number of this periodical contains the status of Federal-aid road construction as of August 31, 1929, together with the following article: A study of Gravel, Topsoil, and Sand-Clay Roads in Georgia, by C. M. Strahan (pp. 117-136).

Methods of research in soil dynamics as applied to implement design, M. L. NICHOLS (*Alabama Sta. Bul.* 229 (1929), pp. 27, figs. 17).—The object of the study of the soil properties discussed in this publication is to obtain a basis for the design of tillage implements. For the purpose of determining the properties affecting design, a small nickel-plated plow was mounted to run beside a glass surface permitting observation of the reaction within the soil. From this and supplemental studies a chart of the variables entering into these reactions was prepared. The study then resolved itself into a determination of the interrelationship of the factors through their most probable range of variation. New methods were evolved for moistening soil and measuring resistance to compression, arch action, cohesion, shear, friction, adhesion, and the effect of shape of surface applying pressure to the soil. Data are reported showing the application of the methods. The study of friction between metal and soil was carried far enough to formulate definite laws covering this phase.

Low-cutting devices for harvesting corn, F. IRONS and W. J. PARVIS (*U. S. Dept. Agr., Misc. Pub.* 56, (1929), pp. 36, pl. 1, figs. 80).—Detailed descriptions are given of a low-cutting attachment for four commercial makes of corn binders

and a low-cutting hand device or hoe, both developed by the Division of Agricultural Engineering of the U. S. D. A. Bureau of Public Roads.

Electric hay hoists, F. E. PRICE, A. W. OLIVER, and E. L. POTTER (*Oregon Sta. Bul. 255 (1929), pp. 16, figs. 9*).—The results are presented of experimental work on hay hoists, which was conducted by the station in cooperation with the Oregon Committee on Electricity in Agriculture.

It has been found that a good power hoist will operate satisfactorily with either fork or slings and can be operated conveniently and satisfactorily by a man on a wagon. It replaces the pull-up team and driver, and makes the use of a gravity pull-back for the fork convenient and practical as the brake will stop or slow up the carriage or fork at any place. At little time is also saved in starting, stopping, and in setting the fork, and the use of a larger fork than can be easily set by hand is made possible since the fork can be put in position on the load largely by the aid of the hoist. The hoist will not elevate the hay faster or in larger loads than is possible with horses without danger of breakage to the carriage or tracks.

It was found that a power hoist uses $\frac{1}{8}$ kw. hour per ton of hay hoisted, and the power costs 1 ct. per ton at a rate of 3 cts. per kilowatt-hour. One h. p. is required for each 135 to 150 lbs. of load at a hoisting speed of 125 ft. per minute.

Experiments on the artificial curing of hay, C. S. NADLER and C. L. OSTERBERGER (*Agr. Engin., 10 (1929), No. 6, pp. 191-193, figs. 5*).—The results of studies conducted at the Louisiana Experiment Stations on hay drying and curing are reported.

By reducing the speed of the feed rolls on a silage cutter it was found possible to chop the hay to any degree of fineness desired. A method of breaking up the large stems of soybeans by passing them through rollers was developed. This device consisted of three grooved cast-iron rolls in housings, so geared that the back roll would run faster than the other two. A deflector or turn plate was placed between the two bottom rolls, and scrapers were provided to remove any materials tending to collect on the rolls.

The drier developed included a furnace of conventional design to burn fuel oil efficiently without smoke. In most of the tests distillate was used because of the ease in regulating the burning of this fuel. Openings are used to dilute the hot gas from the furnace either with air or with some of the outgoing gases. The fire and amount of dilution was controlled manually to maintain the temperature at the head of the drier approximately constant. A thermostat could be used. Hot gases and the evaporated moisture are drawn through the drier by a fan. A stack could also be used. Hay enters above the furnace, and as the drier revolves it is picked up by fingers and dropped through the path of the gases.

Tests showed that by keeping the temperature at the entrance of the drier constant, the temperature at the exit depended upon the amount of moisture fed into the drier with the hay. It was also found that the moisture in the hay at the exit of the drier varied with the temperature at the exit. The exit temperature that would correspond to hay having about 11 per cent moisture was determined, and by placing a thermometer here with an indicator at the cutter, so that the temperature could be read by the man feeding the hay, it was found that he could control the ultimate moisture of the hay to within close limits by varying the amount of hay fed to the drier.

Tests showed an increase in evaporation capacity and in thermal efficiency from time to time until a maximum of 966 lbs. of water per hour with an efficiency of 56 per cent was reached. With an efficiency of 50 per cent, it would take 84.5 gal. of oil to dry enough green hay containing 74 per cent moisture to make a ton of hay dried to 12 per cent moisture. Assuming a price on oil

of 2.5 cts. per gallon, this would cost \$2.12 for fuel per ton of 12 per cent moisture hay.

It was also found that if soybeans are cut after the dew is off and gathered 4.5 hours later, the hay will contain approximately 66 per cent moisture. It would take 54.1 gal. of oil at a cost of \$1.35 to produce from this material a ton of dry hay. It is thought that a machine of such size as is capable of producing 1 ton of dry hay per hour could be economically used.

The color of the hay coming from the drier was about the same as the raw material. The aroma was excellent, and the stock readily ate the artificially cured hay. The few chemical analyses made showed a higher food value in the artificially cured product.

An economic study of farm buildings in New York, I. F. HALL (*New York Cornell Sta. Bul. 478 (1929), pp. 87, figs. 78*).—The results are reported of an investigation the purpose of which was to secure information regarding convenient arrangements for farm buildings. Detailed measurements were made of all buildings except the houses on 122 farms in several counties of New York. The results are given in considerable detail, but no very specific conclusions appear to have been drawn.

Adobe construction, J. D. LONG (*California Sta. Bul. 472 (1929), pp. 56, figs. 35*).—The results of experiments with adobe construction conducted at the station over a considerable period of years are reported. In the course of these the practical and economical value of earth as a construction material for small structures in California has been proved through the actual erection and use of such structures. The use of sundried bricks, rammed earth, and poured earth are the three methods of incorporating earth into the walls of farm buildings of the State which appear practical. It has been found that the apparent strength developed in test specimens and the amount of cracking occurring as the mud dries can be used as an index to the suitability of the soil.

Earth-wall construction is inferior to most standard construction materials in earthquake resistance, but adobe structures have withstood earthquakes in the State with little or no apparent damage. Skillful and intelligent workmanship and the incorporation of certain reinforcing design features help to minimize the damaging effect of earthquakes. A protective coating should be used on adobe walls to guard against moisture and mechanical wear. Cement, lime, and mud plasters, and various paints have been used with success. The advantages of adobe are that it is a native material of adequate strength and durability for residences and small structures, and a material generally economical to use. Attractive, sanitary, comfortable, fire-resistant, dry, sound-proof, and thermal-insulated structures may be erected of the material.

The principal disadvantages attending the use of the material are the following: A large amount of physical labor is involved in such buildings. The low tensile strength requires particular care in securing door and window frames. Additions or alterations in the plan after the work is once started are difficult.

The cost of earth-wall structures varies widely under different conditions. In the State the complete cost of an adobe residence, including items for all labor, commercial materials, and equipment necessary to make the structure available for use, is about the same as for a wood frame structure of similar quality.

The new adaptable poultry house, D. C. KENNARD (*Ohio Sta. Spec. Circ. 15 (1929), pp. 8, figs. 4*).—Revised plans and specifications for the new adaptable poultry house for Ohio conditions are presented together with a bill of materials for a 20 by 20 ft. structure.

A summer shelter for New Jersey pullets, L. M. BLACK (*New Jersey Sta. Hints to Poultrymen, 17 (1929), No. 10, pp. 4, figs. 3*).—Working drawings and a bill of materials for this structure are given.

Farm grain storage, E. G. BOERNER, M. C. BETTS, and T. A. H. MILLER (*U. S. Dept. Agr. Leaflet 46 (1929), pp. 8, figs. 9*).—Practical information is given on grain storage with particular reference to the proper storage of combined wheat. Special attention is given to proper ventilation of bins to reduce losses in damp grains.

The insulation of fruit and vegetable storages, R. D. ANTHONY and F. G. HECHLER (*Pennsylvania Sta. Bul. 241 (1929), pp. 28, figs. 11*).—This publication presents the results of cooperative research on the subject by the station and the Engineering Experiment Station of the Pennsylvania State College.

The results indicate that large air spaces in walls are not efficient. Air spaces should be closed at the bottom and at the top. The tests indicate that the best width of air space is from 0.75 to 1 in. Such a space has about the same resistance to heat transmission as 5 in. of brick wall or 10 in. of concrete, but has only one-third to one-fourth as much as the same space filled with a good insulating material. Since a 0.75-in. air space seems to be the most suitable from the standpoint of insulation and construction, the most efficient arrangement for insulations of the blanket or semirigid type is to place them between the studs, with an air space on each side, rather than in contact with the sheathing on one or both sides. It was found that when blanket and board forms of insulation are built into solid floors or ceilings they are not as efficient as when they are used in layers with air spaces between. Light colors on the roof and walls of a building reflect more heat and absorb less than the darker colors. Windows should be omitted from the storage unless they are absolutely necessary.

The conclusion is also drawn that concrete floors should not be used in air cooled storages because they make the air so dry that the fruit and vegetables will shrivel. A dirt floor is considered better. It has been found that a well-kept grass plat with shrubs and shade trees is of definite value in modifying temperature changes in a fruit storage. Such a storage will be cooler in summer and warmer in winter than a similar structure in a bare and exposed location.

Data from observations of different vegetable storages are presented. An analysis of these indicates that if the exposed walls of a bank cellar approach one-half the total wall surface, additional heat is necessary to prevent freezing in the storage unless these exposed walls have greater resistance to heat flow than is furnished by field stone or concrete. It appears that the ceiling presents a larger surface for heat loss than the walls. In the above ground storage set directly upon the ground, the earth influence is sufficient to give adequate protection and maintain temperatures as high as 35° F. provided the walls and ceiling are properly insulated. In southeastern Pennsylvania 4 in. of regranulated cork with the necessary wood and paper sheathings or its equivalent are sufficient. In the cooler areas of the State 6 in. of cork or its equivalent should be used. Air leakage around doors was found to be a large factor in lowering temperatures to a dangerous degree in severe weather, especially in the above-ground storage.

It is concluded that frost-proof farm storages may be easily and economically constructed when proper use is made of the heat which is given off by the ground during the winter. These storages should have temperatures that run between the ground temperatures and those of the outside air. The greater the contact with the ground and the less the heat loss by ventilation or leakage through the walls the closer the storage temperature approaches that of the ground.

Fires on farms, H. E. ROETHE (*U. S. Dept. Agr. Leaflet 44 (1929), pp. 5, figs. 5*).—Practical information is given on the sources of farm fires and how they may be reduced.

RURAL ECONOMICS AND SOCIOLOGY

Research in progress in the Bureau of Agricultural Economics, June 30, 1929 (*U. S. Dept. Agr., Bur. Agr. Econ., 1929, pp. [4]+96*).—This is a list of the 287 research projects in progress in 14 divisions of the Bureau of Agricultural Economics on June 30, 1929.

[Investigations in agricultural economics at the Missouri Station, 1927-28] (*Missouri Sta. Bul. 272 (1929), pp. 22-26*).—Results of investigations not previously noted are reported as follows:

Farm organization and operation in a central Missouri county, O. R. Johnson and P. Richards.—The percentage of improved land in crops has decreased, but the size of the farm has increased. The average valuation of land is considerably below the pre-war value in terms of exchange value. The average annual interest charge per acre on land in crops is \$7. From 1921 to 1925 the acreage in pasture decreased 18 per cent, and between 1910 and 1925 the amount of livestock decreased over 20 per cent. More than 50 per cent of the owned farms are heavily mortgaged.

Distribution of the labor necessary for caring for brood sows producing two litters per year and for brood sows producing one litter per year, O. R. Johnson.—Records covering the period 1916-1926 show that the average annual labor cost per brood sow was \$1,945 on 25 one-litter farms and \$1,767 on 72 two-litter farms. The labor costs on other hogs on these farms were \$1.249 and \$1.154 per head, respectively.

Average horse hours and equipment cost on Missouri farms, O. R. Johnson and P. Richards.—The average horse hours per farm on farms studied from 1917 to 1926 varied from 3.641 to 6.961.62 for the different years, and the equipment rates per horse hour from 2.95 to 6.6 cts. per hour.

Cost of producing wheat in Missouri, O. R. Johnson and P. Richards.—A table is given showing the cost per acre of different operations, the total cost per acre, and the cost per bushel of producing wheat in 1927.

The cost of keeping a farm flock of sheep, O. R. Johnson and P. Richards.—The average cost per mature sheep for the period 1914-1926 was \$7.457, and the average total income per sheep \$8.973.

The cost of keeping a farm work horse, O. R. Johnson and P. Richards.—Tables are given for the period 1912-1927 showing the average annual feed cost and the cost per hour of labor. These costs corrected for price level by two methods, and the average number of hours of work per horse.

The cut-over lands of northern Idaho, J. H. CHRIST (*Idaho Sta. Bul. 158*¹ (1928), pp. 55, figs. 6).—Information is given regarding soils; climate; land costs; land clearing; soil preparation; tillage; irrigation; cropping methods; use of fertilizers; yields of field crops, fruits, and vegetables; livestock production; dairying; poultry raising; and transportation and markets in northern Idaho. Some of these phases are abstracted elsewhere in this issue.

Soil and field-crop management for Yates County, New York, H. O. BUCKMAN, H. P. COOPER, and F. B. HOWE (*New York Cornell Sta. Bul. 482 (1929), pp. 83, figs. 19*).—The topographic features, climate, market facilities, and soil areas and their agriculture of Yates County, N. Y., are described. Suggestions are made regarding the use of manure, lime, and fertilizers and the rotations and management of different field crops in this section.

¹ The publication previously noted as Bulletin 158 (*E. S. R.*, 59, p. 627) is no longer included in the station series.

Practices on Rhode Island dairy farms, J. L. TENNANT (*Rhode Island Sta. Bul.* 219 (1929), pp. 41, figs. 5).—Tables and charts are included, showing for 104 dairy farms in 5 Rhode Island towns data regarding number of cows, income, herds, breeding practices, diseases, methods of feeding, feed and milk hauling, stabling, and stable equipment and arrangement.

Horses, tractors, and farm equipment, J. A. HOPKINS, JR. (*Iowa Sta. Bul.* 264 (1929), pp. 273-404, figs. 6).—This is the second bulletin reporting the results of the study previously noted (*E. S. R.*, 61, p. 884). Tables and graphs are included showing the averages, by year, 1925-1927, and for selected farms in 1927, for the number of work and other horses, hours of work and crop acres per horse, and net horse, tractor, and total power costs per acre; variation in acreage per horse and cost of horse work and all power cost per acre on farms of different sizes with horses only and with horses and tractors; feed requirements and net expense per year of keeping a horse; fuel consumption and expenses, by items, for tractors; variation in tractor use with size of farm; variation in per hour cost for tractors with different amounts of use; variation in horse performance on tractor and nontractor farms of different sizes; equipment on farms and acres handled with different farm machines on farms of different sizes; time required to perform different farm operations with tractors and different numbers of horses and different size machines; average investment in crop and livestock equipment for different size farms; investment needed to equip farms with 100 and 150 acres in crops; and the annual equipment purchases for farms of different sizes.

The study showed the following facts: The acreage per horse on nontractor farms increased from 12.5 with 80 acres of crops to 25 with from 120 to 150 acres of crops. The expense per year of keeping a horse was from \$60 to \$110, \$90 being typical. Of this expense about 75 per cent was feed. A tractor seemed to be profitable where it permitted the number of horses to be reduced by three. The expense of tractor use generally was about \$1 per hour if the tractor was used less than 300 hours per year. The investment in equipment was \$14 per acre for farms having less than 80 crop acres and \$7 for those with over 160 crop acres. Annual equipment expense varied by about \$1.60 per acre for the two groups of farms. Considering man labor, the 2-bottom, 28-in. plow with 5 horses, and the 9-ft. disk, 20- or 24-ft. harrow, and 2-row cultivator each with 4 horses were the most efficient. Labor, power, and equipment expenses averaged nearly 40 per cent of the gross income for the period for the farms studied.

A comparison of the cost of maintenance of large and of small county boards in the United States, M. S. KENDRICK (*New York Cornell Sta. Bul.* 484 (1929), pp. 41, figs. 5).—This bulletin is based chiefly on data usually for the year 1926 obtained by questionnaires from clerks of county boards in different States. A board of from three to five members is considered small and one of ten members or more large.

Tables are given for Illinois, Michigan, and New York taken as representative of States with large boards; for Iowa, Montana, and Kansas as representative of States with small boards paid on a per diem basis; and for Ohio, Indiana, Utah, and Colorado as representative of States with small boards paid on a salary basis, showing for various counties in each the number of members on the board, the total and average cost per session for compensation and mileage to members, and the number of sessions in relation to the number of members on the board, population of the county in 1920, county taxes levied, and the number of persons in the county per square mile.

Other tables show for Illinois, New York, and Iowa for various counties the compensation and mileage and the number of days of special committee work

in relation to the number of members on the board, number of sessions of the board, population, county taxes levied, and number of persons per square mile. Graphs show for Michigan, Illinois, and New York (per diem basis) the relation of number of members, population, and county taxes levied. Other tables summarize for the representative States, by population groups, the average number of members on the board, the average total cost of all sessions, and the average cost of sessions; and for Illinois, New York, and Iowa, by population groups and county taxes levied groups, the average cost and number of days of special committee work.

The study shows the following facts: The cost per session with large boards is usually large and increases with increases in the number of members. The cost per session with small boards does not increase with increases of taxes levied. The total cost of sessions of both types of boards does not vary so much with the size of the board as with other items. The number of sessions per year is much greater with small boards. The number of sessions of small boards increase but those of large boards do not increase with county taxes levied, total population, or density of population. The difference between the number of sessions for the two types of boards is not equalized by variations in the number of days of special committee work.

The author concludes that on the basis of cost small boards are decidedly to be preferred, and that the average quality of small board members is probably higher than that of members of large boards. The small board functions with much more freedom, and its responsibility to the voters is much more evident.

Farm-property taxation in New York. I. J. CALL (*New York Cornell Sta. Bul.* 485 (1929), pp. 49, fig. 1).—Part 1 (pp. 3–22) presents data regarding taxes, operators' and assessors' valuations, use of taxes, and the relations of taxes to valuations and incomes of small and large farms, soil, and sale prices in several areas of New York. The data cover from 77 to 176 fruit farms in Niagara County for the years 1913–1924, 36 dairy farms in Chenango and Madison Counties for 1921–1923, 271 farms for 1908 and 259 farms for 1913 in three townships of northern Livingston County, 161 farms for 1917 in Tompkins County, 76 farms for 1923 in Chautauqua County, 93 farms for 1923 in Chenango County, and 6,286 acres in Tompkins County in 1925.

Part 2 (pp. 22–46), using the data above, the Report of the New York State Tax Commission for 1924, United States census data, and data from a number of other reports and investigators, analyzes the relations between income and capital in mercantile businesses and on farms; the inequalities in assessing and taxing real estate between counties and towns and within towns; the effects of value of land, size of farm, and proportion of value in buildings on assessments and taxes; and the relations of taxes to land income, farm values, farmers' incomes, and value of farm products. The purposes for which the taxes have been used and the costs of collection are discussed briefly.

Some of the suggestions of the author based on the study follow: To decrease the inequality of taxes, State property taxes should be abolished and a larger part of the taxes should be based on incomes, the proceeds to be used to aid communities in the maintenance of schools and roads. Personal exemptions to income taxes should be lowered. Unless assessment of personal property can be improved, it should be abolished. Part of the funds needed for schools should be raised by property taxes. A county assessor should be provided for each county to study assessments, advise local assessors, do the clerical work, and recommend and assist in making valuations. Taxes should be collected by the county treasurers rather than by the town and school district collectors. Study should be made of governmental business and methods of performing the necessary functions of the different units.

Quality of cotton grown in Georgia, W. T. FULLLOVE and W. B. LANHAM (*Georgia Sta. Bul.* 157 (1929), pp. 28, figs. 7).—Tables and graphs are included showing for the Georgia crops of 1927 and 1928 the number of bales and percentage of bales ginned of different grades and staple lengths, the number of bales tenderable on contracts, and the distribution of American upland cotton ginned, by grades, staple lengths, and period when ginned; the distribution, 1928, of staple lengths by soil areas; and the percentages of different staple lengths consumed by Georgia mills and United States mills studied, August 1, 1927, to July 31, 1928.

The percentages of staple lengths ginned in the two years, respectively, were for $\frac{1}{8}$ in. and under 2.46 and 11.97, $\frac{7}{8}$ in. 77.93 and 70.89, $1\frac{1}{8}$ in. 15.52 and 13.75, 1 and $1\frac{1}{2}$ in. 2.64 and 2.60, and $1\frac{1}{2}$ in. and over 1.44 and 0.70. The percentages of different staple lengths consumed by Georgia and United States mills, respectively, during the period ended July 31, 1928, were for $\frac{1}{8}$ in. and under 1.11 and 1.44, $\frac{7}{8}$ in. 55.99 and 28.81, $\frac{1}{2}$ in. 28.01 and 27.34, 1 and $1\frac{1}{2}$ in. 11.11 and 28.45, $1\frac{1}{4}$ and $1\frac{1}{2}$ in. 0.86 and 5.71, $1\frac{3}{4}$ and $1\frac{1}{2}$ in. 1.94 and 4.19, $1\frac{1}{2}$ and $1\frac{3}{4}$ in. 0.49 and 3.86, and $1\frac{1}{4}$ and above 0.48 and 0.20.

Each year, with the exception of October, 1928, the percentage of white cotton ginned steadily decreased as the season advanced. The length of staple was less affected by advance of the season.

This study was made in cooperation with the U. S. D. A. Bureau of Agricultural Economics.

Marketing Georgia peaches, R. M. MIDDLETON (*Georgia Sta. Bul.* 155 (1929), pp. 21, figs. 7).—Data are presented in tables and graphs showing the production, value, and average price of Georgia peaches; competing shipments of peaches, other fruits, and melons on United States markets; percentage in Georgia of low grades culled in 1928 because of different defects; classification of culls by defects for six commercial varieties; average returns to growers, 1924–1928, per carload and per crate and bushel; and daily carlot shipments for the United States and Georgia and prices by variety and size, 1925, 1927, and 1928.

Marketing of poultry products, G. L. STEVENSON (*South Dakota Sta. Bul.* 243 (1929), pp. 12, figs. 9).—Information is given regarding egg marketing, direct shipping of eggs and chickens, and the preparation of poultry for market.

The livestock review for 1928, H. M. CONWAY (*U. S. Dept. Agr., Misc. Pub.* 54 (1929), pp. 36, figs. 7).—This bulletin of the series previously noted (*E. S. R.*, 60, p. 187) presents statistics and discusses the market supplies and prices of beef cattle, calves, hides, hogs, pork and lard, sheep, lambs, and wool; summarizes the 1928 conditions; and discusses the outlook.

Crops and Markets, [September, 1929] (*U. S. Dept. Agr., Crops and Markets*, 6 (1929), No. 9, pp. 329–376), figs. 3).—This publication includes the usual tables, graphs, reports, and notes on crop acreages, conditions, yields, and production, livestock and livestock products, dairy and poultry products, feed-stuffs, fruits and vegetables, grain, hay, seeds, prices of agricultural products, and cold storage holdings. Also included are the outlook reports for cattle, early potatoes in Florida and Texas, strawberries, and winter wheat, and tables with explanatory text showing by States and years, 1924–1928, the estimated gross value of and gross and net income from crops and animal products, the distribution of gross and net income from 92 items of farm production by commodities, and the estimated gross value of and gross and cash income from farm production in the United States by years, 1924–1928, by commodities.

Farmers' cooperative associations in the United States, 1929, C. L. CHRISTENSEN (*U. S. Dept. Agr. Circ.* 94 (1929), pp. 66, figs. 8).—This circular

describes the development and present status of cooperative associations for the marketing of different fruits and vegetables, grain, rice, cotton, tobacco, livestock, wool, and eggs and poultry, for buying farm supplies, and for cooperation among cooperative associations.

A study of the business practices of farmers' local cooperative purchasing associations in Pennsylvania, J. K. STERN (*Pennsylvania Sta. Bul.* 242 (1929), pp. 30, figs. 15).—This bulletin reports the results of a study of the management and business practices of local cooperative purchasing organizations in Pennsylvania with a view of ascertaining the factors affecting capital requirements. It is based chiefly on the annual reports and records of the associations and interviews with 51 managers of nonstock and 14 managers of stock organizations.

Tables and graphs with explanatory text are included showing for selected associations the number and size of feed accounts charged by months, size of charge accounts, increase of sales due to the extension of credit, losses due to bad debts, interest rates on credit accounts, seasonal variation in size of accounts and collections, frequency and amount of credit extended for different periods of time, margins charged, savings or earnings, and reserves. Price cutting, patronage dividends, auditing, management, statements to customers, and the Pennsylvania cooperative acts of 1919 and 1929 are discussed briefly.

[Investigations in rural sociology at the Missouri Station, 1927-28] (*Missouri Sta. Bul.* 272 (1929), pp. 81-83).—Investigations are reported on as follows:

Movements of rural population in Missouri, E. L. Morgan.—Information secured by correspondence on the migration of 1,000 farmers in 12 counties showed that of the migrants 81 per cent were owners and 19 per cent tenants. Fifty-nine per cent were known as leaders in the community they left, 64 per cent were members of farm organizations, 70 per cent church members, 84 per cent left farms on improved roads, 48 per cent moved to obtain better educational facilities, 21 per cent for economic reasons, and 10 per cent to obtain better church facilities. The average distance moved was 8 miles.

Factors influencing the effective location of rural groups, E. L. Morgan.—A study was made of 54 institutions—churches, libraries, hospitals, farm groups, community centers, and small-town chambers of commerce. Of those gaining in membership, 91 per cent were in communities that had gained in population during the last decade. They were located in communities included in the upper one-half in the public school teacher salary ratings of the State. The average tenure of service of their leadership was three years, and the program of work was continually being adapted to the community needs. Of those declining in membership, 87 per cent were in communities in which the population had decreased. They were located in communities in the lower one-fourth in the teacher salary ratings and the lower one-third of the ranking of public schools in the State. Ninety-two per cent were in communities having active social cleavages. The leadership tenure was 1.5 years, and there had been no perceptible change of program in the three years.

The process of community organization, H. J. Burt.—Records of attendance at all gatherings in the Ashland, Mo., community for a period of three months showed that 89 per cent of the social contacts experienced were within the community, 20 per cent being in the form of visiting. The average contacts per person varied from 1.9 to 50.2 in different school districts. The cost of providing contact facilities by organizations varied from 1 ct. to \$1.14 per contact per person.

An economic study of the collection of milk at country plants in New York, L. SPENCER (*New York Cornell Sta. Bul.* 486 (1929), pp. 47, figs. 17).—The

data upon which this bulletin is based were chiefly for the year ended April, 1924, and consisted of a 12-months record of the quantity of milk delivered by each dairyman at 56 country plants in three areas in central New York; data as to the method of delivery and kinds of vehicles used by haulers to 20 plants supplied by 1,547 dairymen; records of estimated daily hauling time, kinds of vehicles, and other data for computing costs obtained from 204 individual dairymen who hauled their own milk; and detailed records of milk hauling costs and of returns for hauling from operators of 76 commercial hauling routes. Tables and graphs are included showing the hauling distances and the amounts of milk received by types of plants, methods of hauling, and types of vehicles used for different distances hauled; summaries of data as to distances hauled, roads, load, costs per trip and per 100 lbs., etc., for individuals and commercial haulers using horses and trucks; relation of size of load to cost of hauling by individuals and commercial haulers; relation of distance to cost for individuals; costs of operating trucks of different sizes; and rates charged by commercial haulers.

With the advice of county farm bureau managers and persons engaged in milk hauling, a map was prepared locating 14 essential milk plants to replace 31 plants in operation at present, and tables are given showing the estimated effects on hauling distances and costs, costs of plant operation, and shipping costs for the 14 plants. The obstacles to eliminating nonessential milk plants and the desirable locations for plants in the State are discussed.

A study of farm migration in selected communities in the State of Washington. A. A. SMICK and F. R. YODER (*Washington Col. Sta. Bul.* 233 (1929), pp. 41, figs. 11).—The data analyzed in this bulletin were obtained by visits to 552 families in 3 counties and cover 1,031 males and 965 females 16 years of age and over, either living on the farm or having left the farm. The geography and historical development of the counties are described.

Tables are given and discussed showing for each county the number and percentage of males and females who had left the farm, and for males the age at which they migrated, their occupations after migrating, and the reasons for migrating. Another table shows for males migrating and those remaining on the farm the average age at which they began full-time work, years of working out while under 21, percentage allowed to help in planning the farm work, percentage receiving wages while under 21, and months and hours per day of labor during the busy season. Other tables show for persons migrating and those remaining on the farm data as to recreation and amusements, attendance at church, Sunday school, and young people's meetings, home conveniences, access to and use of different kinds of reading matter at 10 to 20 years of age, school attendance, and average grades obtained in the eighth grade State examinations.

Of the males 16 per cent and of the females 22 per cent had left the farm. Of 147 males who migrated 54 left under 20 years of age and 76 from 20 to 30 years of age. The reasons for migrating were largely economic. The study seems to indicate that the age of beginning full-time work, hours of chores per day, sharing in crops and planning of work, hours per day worked, and the receiving of wages while under 21 were small factors in influencing boys to leave or remain on the farm. The persons migrating participated in more social activities, Sunday school, church, and young people's meetings, were from better equipped homes, were more fully supplied with reading material, had continued in high school longer, a higher percentage read the available reading material, and attended college longer. The persons remaining on the farm had a slightly higher average in the eighth grade State examinations.

The study indicates that the migration from the farms to the city is not noticeably selective, that the farming communities can contribute a fairly large

number of persons of superior ability to the cities and still maintain a progressive and virile community, and that the social problem of rural communities is not how to keep a higher percentage of their young people on the farm but to provide the richest opportunities for the growth and development of those not leaving.

The study was made in cooperation with the U. S. D. A. Bureau of Agricultural Economics.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Proceedings of the forty-second annual convention of the Association of Land-Grant Colleges and Universities, edited by C. A. McCUE (*Assoc. Land-Grant Colls. and Univs. Proc.*, 42 (1928), pp. 475, pl. 1, figs. 25).—This is the customary report of this convention (*E. S. R.*, 59, p. 787) held at Washington, D. C., November 20–22, 1925, and previously discussed (*E. S. R.*, 60, pp. 1, 100, 101).

The following papers, together with discussions, are included: Presidential address—The Builders of the Association, by J. L. Hills (pp. 24–35); What the Land-Grant Institutions Have Accomplished, by H. L. Russell (pp. 35–37); Report of the Bibliographer—Scientific and Technical Societies dealing with Agriculture and Related Subjects, by A. C. True (pp. 37–58); Address of the Secretary of Agriculture, W. M. Jardine (pp. 58, 59); Address of the Director of Scientific Work, U. S. Department of Agriculture, A. F. Woods (pp. 59–65); Address of the Master of the National Grange—Training for Leadership, by L. J. Tabor (pp. 65–70); What the Land-Grant Institutions Have Accomplished, by F. L. McVey (pp. 70–72), F. D. Farrell (pp. 72–74), and A. M. Soule (pp. 74–76); The Land-Grant College Survey, by A. J. Klein (pp. 79–84); Address of the Secretary of the Interior, R. O. West (pp. 84–86); Some Observations on Shop and Farm, by M. Thorpe (pp. 86–93); Agricultural Research, by F. B. Mumford (pp. 94–96); The Station Director, His Relationships and His Responsibilities, by S. B. Doten (pp. 97–100); Cooperation with Organized Agricultural Producers, by E. D. Merrill (pp. 101–104); Federal Plant Quarantine Act of August 20, 1912, by C. L. Marlatt (pp. 104–108); Organized Labor and Capital and Unorganized Agriculture, by J. L. Coulter (pp. 108–116); The Agricultural Experiment Station—An Institute for Fundamental Research in Rural Affairs, by E. M. Freeman (pp. 116–125); Student Elimination: Its Causes and Its Implications, by A. W. Gibson (pp. 126–134); A Plea for High Standards of Instruction in Agriculture, by E. D. Merrill (pp. 135–141); The Special Field of Non-degree Courses in Our Agricultural Colleges, by R. H. Verbeck (pp. 141–145); A Three-in-One Curriculum, by F. H. H. Calhoun (pp. 145–150); The Widening of Markets for Agricultural Products through Research, by H. G. Knight (pp. 151–153); Progress and Problems in Home Economics Research, by S. L. Smith (pp. 153–167); Rural Sociology as a Field of Research in the Agricultural Experiment Station, by W. Gee (pp. 167–177); Where Should the Emphasis be Placed in Developing Research in the Field of Agricultural Economics? by L. A. Moorhouse (pp. 177–182); Promising Lines of Agricultural Engineering Research, by R. W. Trullinger (pp. 182–190); Cooperation in Research between the United States Department of Agriculture and the State Colleges and Experiment Stations, by A. F. Woods (pp. 190–194); Administrative Responsibilities in the Functioning of Research, by E. W. Allen (pp. 194–203); The Influence to Date of Smith-Lever Extension Work on Rural Life, by C. B. Smith (pp. 213–218); Effective Methods of Creating Sentiment for the Employment of County Home Demonstration Agents, by F. L. Brown (pp. 219–229); Suggestions for Fuller and More Effective Development of 4-H

Club Work, by P. C. Taff (pp. 230-240); Costs of Extension Methods as Related to Changed Farm and Home Practices, by H. J. Baker (pp. 240-248); Economic Information in the Bureau of Agricultural Economics Available for Extension, by N. A. Olsen (pp. 251-255); Continuous Information on the Outlook for Pork Production and Its Usefulness to Farmers, by M. Ezekiel (pp. 255-260); Current Facts on the World Wheat Situation as a Basis for a Wheat Marketing Program, by O. C. Stine (pp. 260-263); How Apple Growers Can Profit by Economic Research, by H. R. Tolley (pp. 263-274); Successful Methods of Extending to Farmers the Economic Information Developed by the Bureau of Agricultural Economics and the State Experiment Stations, by B. W. Ellis (pp. 274-282); Industrial Engineering and Management in Curricula of Land-Grant Colleges and Universities, by E. A. Hitchcock (pp. 283-297); Agricultural Engineering in Land-Grant Colleges and Universities, by R. A. Seaton (pp. 297-309); The Land-Grant College as the Agency for Securing the Economic Utilization of Natural Resources, by H. B. Shaw (pp. 310-320); Engineering Research in Land-Grant Colleges, by A. Marston (pp. 322-325); Cooperation of Land-Grant Colleges and Universities with Industry, by A. A. Potter (pp. 326-337); Engineering Extension Instruction in Land-Grant Colleges and Universities, by R. L. Sackett (pp. 337-349); Course in Public Speaking at the Engineering College, University of Maryland, by A. N. Johnson (pp. 349-351); The Influence of the Land-Grant College on Engineering Education, by C. A. Lory (pp. 356-362); Non-degree Engineering Education in Land-Grant Colleges and Universities, by R. H. Spahr (pp. 362-377); Some Problems of Engineering Teaching Personnel, by H. P. Hammond (pp. 378-390); Trends of Enrollment in Land-Grant Colleges, by W. B. McNeal (pp. 391-403); Study of Land-Grant College Survey of Home Economics Undergraduate Work, by M. Van Rensselaer (pp. 404-414); The Teaching Load: How Are Differences in Undergraduate Teaching Loads Measured? by A. L. Marlatt (pp. 416-423); Status of Purnell Research in Home Economics, 1928-29, by S. L. Smith (pp. 430-434); and Progress of Work in Child Care and Training, by A. E. Richardson (pp. 436-439).

Reports of the following committees are also included: Executive, Intercollegiate Judging Contests, Experiment Station Organization and Policy, Projects and Correlation of Research, Publication of Research, Extension Organization and Policy, Engineering Experiment Stations, National Purnell Committee on Vitamin Content of Food in Relation to Human Nutrition, National Purnell Committee on Rural Home Management Studies, Orientation Course for Freshman Students as Offered by Home Economics Departments, College Organization and Policy, Military Organization and Policy, Instruction in Agriculture, Home Economics, and Mechanic Arts, Radio, and Division of Work between Land-Grant Institutions and State Boards of Agriculture.

[Eleventh and twelfth annual reports to Congress of the Federal Board for Vocational Education, 1927 and 1928 (*Fed. Bd. Vocat. Ed. Ann. Rpts.*, 11 (1927), pp. IX+73, figs. 11; 12 (1928), pp. IX+70, figs. 11).—These reports to Congress present a general review of the work of the board and statistical reports of the work under the national vocational education act of February 23, 1917, and the national civilian vocational rehabilitation act of June 2, 1920.

Vocational education in home economics under the George-Reed Act, A. S. BAYLOR (*Jour. Home Econ.*, 21 (1929), No. 9, pp. 645-649).—The provisions of the George-Reed Act, approved February 5, 1929, are discussed. A statement of policies under the act and an outline of the three programs of all-day schools are included.

Suggested outline for content of course and methods of teaching social and family relationships in high school home economics classes, J. S. HINKLEY (*Lincoln: Nebr. Univ. Col. Agr., Dept. Vocat. Ed., 1929, pp. 37*).—The

objectives in social and family relationships and the steps in the development of personality traits are discussed, and two suggested plans for the organization of units are given.

How to find economic facts and apply them as a basis for extension programs in home economics, dairying, and forestry, F. E. WARD (*U. S. Dept. Agr. Misc. Pub. 52* (1929), pp. 10).—The plans worked out by the home economics, dairy, and forestry sections of the conference of State directors of extension work. State leaders of home demonstration work, and specialists in home economics, dairying, and forestry of the Eastern States, held at Washington, D. C., February 26–28, 1929, are outlined.

Dairy Day (*Ohio Sta. Spec. Circ. 22* (1929), pp. 4, fig. 1).—A program for Ohio Dairy Day held at Wooster, August 9, 1929.

Ohio Poultry Days (*Ohio Sta. Spec. Circ. 19* (1929), pp. 4, fig. 1).—The programs for Ohio Poultry Days held at Wooster, June 20 and 21, 1929.

Wheat and Clover Days (*Ohio Sta. Spec. Circ. 20* (1929), pp. 4, fig. 1).—This is a program of the papers and demonstrations presented at the Ohio Station on June 26 and 27, 1929.

FOODS—HUMAN NUTRITION

Modern conceptions of nutrition, S. J. COWELL (*Lancet* [London], 1929, I, No. 19, pp. 994–998).—This lecture deals with present conceptions of the rôle and requirements of proteins, fats, carbohydrates, and salts in human nutrition.

A laboratory handbook for dietetics, M. S. ROSE (*New York: Macmillan Co., 1929, 3 ed., pp. XIV+269, figs. 2*).—In the present revision of this well-known handbook (E. S. R., 28, p. 257) special attention has been given to quantitative data on the calcium, phosphorus, and iron content of foods and to unit values for vitamins A, B, and C as far as at present determined. The volume also contains a new table of 100 calorie portions and calories in common measures and a table giving food values in shares according to the method previously suggested (E. S. R., 59, p. 188). Among other changes and additions are a revision of the problems in dietary calculation to correspond with changes in methods of studying the nutritive value of foods, and the inclusion of the Du Bois chart for determining surface area of the body from weight and height and of a bibliography of sources of information on the composition of foods.

Some comparisons of the nutritive value of whole wheat bread and white bread, S. M. HAUGE and A. P. BEADLE (*Jour. Home Econ., 21* (1929), No. 3, pp. 199–208, figs. 3).—In this investigation whole wheat bread and white bread, both made without milk from the same recipes, were compared in feeding experiments on rats for their nutritive value with respect to vitamin G, protein, and minerals, in each case the nutrients in question being the only limiting factor.

The whole wheat bread proved superior to that made from the patent flour in each of these factors. In commenting upon these results, the authors state as follows: "It is not necessary to be concerned over the deficiencies of the white bread and discredit the value of this bread in the diet, nor is it necessary to advocate the use of whole wheat bread. The dietary habits of the American people are such that any deficiencies of one food item, as bread, may be amply supplemented by other foods—eggs, dairy products, and vegetables. But where bread constitutes an unduly large proportion of the diet, then the deficiencies of white bread may lead to malnutrition which could have been prevented by the use of whole wheat bread."

Pork in preferred ways, L. M. ALEXANDER and F. W. YEATMAN (*U. S. Dept. Agr. Leaflet 45* (1929), pp. 8, figs. 7).—This leaflet, similar to the ones on beef

(E. S. R., 58, p. 491) and lamb (E. S. R., 60, p. 89), contains directions for roasting fresh ham and pork loin with the use of a meat thermometer and for the cooking of pork products in various unusual ways, including panned pork chops, stuffed rib chops with apples, breaded pork fillets, pork chop suey, sausage and fried pineapple, and roast stuffed pork shoulder and spareribs. Recipes are included for savory stuffing, glazed apple rings, and candied sweet potatoes.

Investigations with a carbohydrate-low diet [trans. title], P. GRÓGNY and H. KELLER (*Biochem. Ztschr.*, 206 (1929), No. 1-3, pp. 120-125, fig. 5).—These studies were undertaken on account of the gradual tendency in the artificial feeding of infants toward low carbohydrate and high protein foods, such as protein milk. Groups of young rats, from 15 to 25 days old at the beginning of the experiment, were fed for varying periods of time up to 101 days synthetic food mixture differing only in their content of carbohydrate and protein.

On diets practically free from carbohydrate, growth was equal to that on the same synthetic diet containing carbohydrate. Both diets did not bring about as rapid growth as a normal mixed diet. On the carbohydrate-free diet there was no evidence of hypoglycemia and only occasionally a slight tendency toward low blood sugar. Protein-rich diets led to a relative hypertrophy of the kidneys.

Growth and reproduction of rats on vegetarian diets, H. WU and T. T. CHEN (*Chinese Jour. Physiol.*, 3 (1929), No. 2, pp. 157-169, figs. 3).—Four generations of rats have been raised on two vegetarian diets, previously found to be satisfactory for growth (E. S. R., 60, p. 591). These consisted of whole wheat 35, millet 30, peas 15, soybeans 15, sesame oil 5, and sodium chloride 1 per cent, supplemented by small cabbage or colza ad libitum. The successive generations have been compared with rats on the stock diet used in the authors' laboratory.

Considerable seasonal variation having been noted, the records were separated into summer (March 15 to August 15) and winter. The summer records of the rats on the vegetarian diets were quite comparable to the normal animals on the stock diet, but the winter records were decidedly below normal. This is thought to be due to differences in composition of the fresh vegetables in winter and summer. Fertility records showed no differences between summer and winter, but lactation was more successful in the summer.

The composite growth curves of a large number of rats from each generation showed a decreasing rate of growth for each succeeding generation. With the exception of the second generation, the rats on the vegetarian diets seemed to be as fertile as the stock rats. This is thought to show an adaptation to the vegetarian diet. This adaptation was also shown in the lactation records. The vegetarian diet was improved by additions of cod-liver oil, butter, yeast, and salt mixture, respectively. This is interpreted as showing slight deficiencies in vitamins A, D, and G, and in calcium.

In the authors' opinion the average Chinese diet, which is almost vegetarian, belongs to the same category as the experimental diets used in this study and accounts, to some extent, for differences in physique and efficiency between the Chinese and Westerners.

Basal metabolism of omnivorous and vegetarian rats, H. WU and T. T. CHEN (*Chinese Jour. Physiol.*, 3 (1929), No. 3, pp. 315-323).—Basal metabolism determinations are reported for 95 rats from 5 to 9 months of age subsisting on the vegetarian diet described in the paper noted above, and 96 of the same age limits on Sherman diet B. The metabolism of the rats on the vegetarian diet was somewhat lower than of those on the so-called omnivorous diet. The differences amounted to 2.8 per cent for the males, and 4.2 for the females. It is

considered that the lower basal metabolism of the vegetarian rats is open to two interpretations, (1) the lower coefficient of digestibility of the protein of the vegetarian diet, and (2) the lessened vigor of the vegetarian rats ascribable to the diet as a whole rather than to any one constituent.

"While the present finding is in harmony with the hypothesis that the lower basal metabolism of the Chinese is ascribable to the diet, it does not exclude the possibility that the lower basal metabolism of the Chinese is due to the lowered physical standard which, in the case of the vegetarian rats is ascribable only to the diet, but in the case of the Chinese may be the result of other factors of the environment."

Physical measurements of boys and girls of native white race stock (third generation native born) in the United States: Physical measurement studies No. 1, S. D. COLLINS and T. CLARK (Pub. Health Rpts. [U. S.], 44 (1929), No. 1c, pp. 1059-1083, figs. 12).—This paper, which is the first of a series of papers on the physical measurements of nearly 30,000 school children of native white parents and grandparents in various parts of the United States, deals with the mean measurements of girls and boys at different ages and the annual increments in those measurements as indicated by the differences between the means at successive ages. The measurements included standing height or stature, sitting height or trunk length, weight, chest circumference at rest, transverse diameter or width of chest, anteroposterior diameter or depth of chest, and vital capacity. The children were weighed without shoes or outside coats or wraps.

The data show that with increasing age weight and vital capacity increased more rapidly than any of the other measurements taken. Between the ages of 11 and 15 years, inclusive, all the mean measurements except vital capacity and transverse chest diameter were larger for girls than boys. The mean annual increments for girls exceeded those for boys for a period of three years or more between the ages of 6 and 13 years, the largest increases being at from 11 to 12 years. From 13 to 14 years the mean annual increment for boys was larger than for girls for all measurements.

The insensible perspiration in infancy and in childhood.—I, Its constancy in infants under standard conditions and the effect of various physiologic factors, S. Z. LEVINT, J. R. WILSON, and M. KELLY (Amer. Jour. Diseases Children, 37 (1929), No. 4, pp. 791-806, fig. 1).—A further study of the factors affecting insensible perspiration in infants (E. S. R., 59, p. 592) is reported, together with a description of the apparatus and experimental procedure for the determination.

The conditions adopted for securing basal measurements are as follows: "(1) A range of environmental temperature between 23 and 25° C. in the absence of visible perspiration; (2) an environmental relative humidity between 25 and 54 per cent; (3) the minimal amount of clothing compatible with comfort, that is, a thin cotton shirt, a nightgown of light-weight flannel, cotton stockings, and a rubber mattress without bedding; (4) a condition of sleep and the absence of muscular activity; and (5) the ingestion, at least one hour preceding the onset of observation, of small meals containing fewer than 25 calories per kilogram of body weight and weighing between 20 and 40 gm. per kilogram."

Under these standard conditions, which are not claimed to yield absolutely minimal values but to be most applicable for general use, the basal rate of insensible perspiration in infants was found to be constant within the limits of experimental error from day to day. Perspiration, muscular activity, and food intake within an hour of the determination were found to have a stimulating effect on the rate of insensible perspiration.

Vitamin content of honey and honeycomb, H. B. KIFER and H. E. MUNSELL (*Jour. Agr. Research* [U. S.], 39 (1929), No. 5, pp. 355-366, figs. 2).—This contribution from the Bureau of Home Economics, U. S. D. A., consists of the detailed report, with composite growth curves and individual weight records and, in the vitamin C studies, with autopsy findings, of an investigation of the vitamin content of three samples of honey representing extremes of color variations. One of the samples was a white clover honey from Ohio, another a dark buckwheat honey from New York, and a third a light-colored white clover honey from Vermont. None of the honeys had been heated. The third sample was received in the comb, and the comb, pressed as free from adhering honey as possible, was also used in the feeding tests.

No detectable amounts of vitamins A, B, C, or D were found in any of the honeys or in the honeycomb.

The vitamin content of honey, E. HOYLE (*Biochem. Jour.*, 23 (1929), No. 1, pp. 54-60, figs. 2).—Samples of fresh English comb honey and a granular honey of West Indian origin were found to be deficient in vitamins A, B₁ (F), B₂ (G), C, and D. In all of the tests except for vitamin C the amount of honey fed daily was 2 gm. per animal. In the test for vitamin C the dosage was begun at 3 gm. and increased up to 5.9 gm.

Vitamins in canned foods.—VII, Effect of storage on vitamin value of canned spinach, W. H. EDDY, E. F. KOHMAN, and N. HALLIDAY (*Indus. and Engin. Chem.*, 21 (1929), No. 4, p. 347).—In continuation of the series of studies previously noted (E. S. R., 59, p. 94), canned spinach of the 1925 pack used in a previous study (E. S. R., 53, p. 794) showed little deterioration in its content of vitamins A and C after three years' storage.

The growth vitamin A.—I, Vitamin A—taurocholic acid [trans. title], T. SHIMIZU and T. HATAKEYAMA (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 182 (1929), No. 1-2, pp. 57-71, figs. 5).—By the addition of desoxycholic acid to a concentrate of vitamin A, the authors have prepared a vitamin A-taurocholic acid which crystallizes from absolute ethyl alcohol in yellow rosette-forming needles. The e can be further purified with absolute ether or chloroform and recrystallized from aqueous alcohol. The purified crystals have a melting point of 179° C., are readily soluble in alcohol and acetone, moderately soluble in glacial acetic acid or acetic anhydride, and difficultly soluble in chloroform and ether. On treatment with xylol the vitamin is said to separate in colorless needles. On distillation in vacuo the vitamin also separates, crystallizing in long needles melting at 187°. In this form it is difficultly soluble in ethyl alcohol and readily in chloroform, ether, and glacial acetic acid. It gives with Liebermann's reagent an orange-red color, changing to violet-red and then to blood-red. On hydrogenation the substance shows the presence of two bonds, the hydrogenated product being in the form of a yellow oil. Its iodine number is 123 and comes within 95 per cent of the theoretical for two double bonds.

Feeding experiments with mice are reported, demonstrating the activity of the substance as a source of vitamin A.

Development of vitamin A during ripening of tomatoes, A. F. MORGAN and L. L. W. SMITH (*Soc. Expt. Biol. and Med. Proc.*, 26 (1928), No. 1, pp. 44-47).—The tomatoes used in this investigation were picked when green, but completely matured, divided into six lots, and treated as follows: One lot was ground and placed in small glass jars, the air in which was replaced by carbon dioxide. The other lots were ripened in diffuse light, in the dark, in ethylene (1 to 2,000 parts) for 1 week, and in the dark except for three periods of ultra-violet irradiation of 30 minutes each at a distance of 12 in. During the ripening the temperature, ventilation, and humidity were kept constant. An attempt

was made to bring all to the same degree of ripeness as determined by color comparisons with Tallquist hemoglobin standards, but the results were not particularly satisfactory. A final lot was allowed to ripen on the vines, and all of the ripened lots were kept in evacuated glass jars, as was the unripened lot.

In the feeding tests rats were placed at 21 days of age on a basal diet consisting of baked and alcohol-extracted casein 18, irradiated Crisco 5, agar 2, Osborne and Mendel salt mixture 4, and dextrin 71 parts and were given the material to be tested after eye disease and loss in weight had developed in from 30 to 40 days. The feeding was continued for 8 weeks, and attempts were made to adjust the dosage to furnish sufficient vitamin A for growth at a rate of from 6 to 8 gm. a week. From 1 to 5 rats were used for each dosage.

Green tomatoes appeared to be less rich in vitamin A than ripe, but no appreciable difference could be noted between the vitamin A content of tomatoes ripened in various ways.

Vitamin B terminology, R. A. DUTCHER ET AL. (*Science*, 69 (1929), No. 1784, p. 276).—In this second report of the committee on vitamin B nomenclature of the American Society of Biological Chemists (E. S. R., 60, p. 492), the following recommendations are made:

"(1) That the term 'Bios,' as suggested by the British workers, be retained to denote the factor or factors encouraging the rapid growth of yeast cells. (2) That the term 'B' be restricted to designate the more heat-labile (antineuritic) factor. (3) That the term 'G' be used to denote the more heat-stable, water-soluble, dietary factor, called the P-P (pellagra-preventive) factor by Goldberger and associates, and which also has to do with maintenance and growth. (4) That the naming of newly discovered dietary factors, by other than descriptive terms, should be discouraged until their identity is established beyond question."

Detection of the formation of vitamin B by *Bacterium vulgatus* (Flügge) Migula by means of a simple new method [trans. title], M. SCHENKLICH (*Biochem. Ztschr.*, 207 (1929), No. 4-6, pp. 458-461, fig. 1).—By feeding rats on a vitamin B-free diet supplemented with cultures of *B. vulgatus* grown on a vitamin B-free culture medium, the author has been able to cure the symptoms of B deficiency, and thus to demonstrate the synthesis of vitamin B by this organism.

The relation of the growth of certain micro-organisms to the composition of the medium.—IV, The addition of mannitol, V. READER (*Biochem. Jour.*, 23 (1929), No. 1, pp. 61-67, fig. 1).—In continuation of the series of studies noted previously (E. S. R., 60, p. 411), a clue has been obtained to the apparently anomalous results occasionally noted in the use of *Streptothrix corallinus* in estimating vitamin B₁ (E. S. R., 60, p. 412) by the discovery that mannitol is capable of bringing about an increase in the growth of pure cultures of the organism. It is thought that the effects are due either to the whole or a part of the mannitol acting as a specific food supply rather than as a growth-promoting factor.

Influence of the method of preparation on the vitamin B content of spinach and string beans, M. C. HESSLER and E. C. ROGERS (*Missouri Sta. Bul.* 272 (1929), pp. 66, 67).—In this progress report the following data are given:

"Cooking reduced the content of water-soluble B vitamin in spinach. The vitamin B losses as measured by the growth unit were 33-41 per cent for that cooked 7 minutes in the open kettle, 46-51 per cent for the 15-minute cooked product. Losses in canning by household methods were 60-63 per cent, and 77-81 per cent in the commercial product. How much of this loss was due to the reduced amount of the F factor can not be stated quantitatively at this time. Raw beans contained less F than raw spinach. Open kettle cooking and

home and commercial canning do not appear to affect the content of G in string beans but do reduce the F content."

Vitamin C content of spinach and Jonathan apples, M. C. HESSLER and G. CRAIG (*Missouri Sta. Bul.* 272 (1929), pp. 67, 68).—In this study, guinea pigs were given the Sherman-LaMer basal diet supplemented from the start with the material to be examined. The animals were irradiated daily. It is stated that of raw Jonathan apples tested from September to December, 20 gm. did not "appear to contain quite a unit of vitamin C," and that from December to February from 30 to 40 gm. was required to afford the same degree of protection.

Spinach cooked in an open kettle for 15 minutes was estimated to be only one-third to one-fourth as rich in vitamin C as the raw or commercially canned product. In unit values the fresh raw spinach is given as 5 to 7 gm., open kettle cooked more than 15, and commercially canned from 7 to 9 gm.

The antiscorbutic property of apple and rhubarb, M. C. HESSLER and Z. WILLIAMS (*Missouri Sta. Bul.* 272 (1929), p. 68).—In this study of the vitamin C value of apples cooked in various ways and rhubarb canned by two different methods, the guinea pigs were kept on the basal vitamin C-free diet for from 7 to 14 days before the foods to be tested were fed. The protective dose of raw apples from November to January was found to be 20 gm. Fresh sauce from these apples was of practically no value, and 25 gm. of apple treated with salt solution and sterilized in glass jars contained considerably less than a protective dose. Apple sauce cooked with the addition of 0.056 gm. of citric acid to 20 gm. of apple was not completely protective in 25-gm. doses. A sauce made by cooking apples and lemon juice for 15 minutes in the proportion of 20 gm. of the former to 0.8 cc. of the later gave almost no protection.

Rhubarb canned by the open kettle method and tested after 4.5 months' storage afforded complete protection in 12-gm. amounts and appeared to lose none of its antiscorbutic value after 15 minutes' heating. Rhubarb canned in cold water and made into sauce after 4.5 months' storage by heating 15 minutes in the open kettle was almost entirely lacking in vitamin C. Rhubarb with the acid partly neutralized before cooking showed no difference in potency from untreated rhubarb when fed in 25-gm. amounts. No attempt was made to determine the minimum protective dose of the rhubarb treated in this manner.

The antirachitic factor in burbot-liver oil, B. CLOW and A. MARLATT (*Indus. and Engin. Chem.*, 21 (1929), No. 3, pp. 281, 282).—A quantitative comparison of the antirachitic value of a commercial brand of medicinal cod-liver oil and freshly prepared oil from the livers of the burbot fish is reported, indicating that the burbot-liver oil was practically eight times as active as the cod-liver oil. The authors call attention to the abundance of the burbot (often called lawyer fish or eel pout) in inland lakes and streams, and to the relatively large size of the livers of this fish.

The antirachitic value of irradiated ice cream, W. C. RUSSELL, F. C. BUTTON, and O. J. KAHLENBERG (*Jour. Dairy Sci.*, 12 (1929), No. 3, pp. 231-241).—It has been found possible by suitable irradiation of ice cream mix prepared from winter cream to give it sufficient antirachitic value to heal rickets in rats, while the corresponding nonirradiated product was without effect. For the irradiation, 25 to 50 cc. of the mix was exposed in a thin film in a shallow Pyrex pie dish 9 in. in diameter to the rays of a Cooper Hewitt Uviarc Poultry Treater lamp at a distance of 12 in. for 2 and 10 minutes, and later at a distance of 4 in. for 15 seconds.

The samples exposed for 10 minutes had a fishy flavor which could not be prevented by passing an air current between the mix and the lamp during

irradiation to drive off ozone. The flavor of the samples exposed for 2 minutes and for 15 seconds, respectively, was not objectionable.

In testing for rickets the technic of Bills, Honeywell, and MacNair (E. S. R., 58, p. 795) was followed with slight modifications, curative tests being employed and a ++ healing the criterion for satisfactory cure. Determinations were made of the bone ash and the inorganic phosphorus of the blood.

After preliminary trials it was found that the desired ++ healing could be accomplished when an 8 per cent fat ice cream, irradiated for 10 minutes, was fed at a 4 per cent level, while there was no cure on the nonirradiated mix at an 8 per cent level. An increase in the butterfat content of the mix decreased the time of exposure required. In three out of five animals receiving the mix containing 12 per cent fat irradiated for 15 seconds at 4 in., a ++ healing was secured.

Variations in the temperature of the product during irradiation between 15.5 and 62.5° C. did not affect the activity of the material, nor was the antirachitic value of irradiated ice cream lowered by freezing and low storage temperature for at least two months.

A definite correlation was not found between the level of inorganic blood phosphorus and the degree of healing as expressed by the line technic, nor was there any agreement between the results by the line test and the percentage of bone ash.

Ergosterol, isolated from a Japanese edible mushroom, Cortinellus shiitake [trans. title], M. SUMI (*Biochem. Ztschr.*, 204 (1929), No. 4-6, pp. 397-411, figs. 15).—Essentially noted from another source (E. S. R., 59, p. 595).

The toxicity of irradiated ergosterol [trans. title], H. SIMONNET and G. TANRET (*Procsse Méd. [Paris]*, 37 (1929), No. 29, pp. 468, 469; also in *Compt. Rend. Soc. Biol. [Paris]*, 160 (1929), No. 8, pp. 548-556).—Recent literature on the harmfulness of large doses of irradiated ergosterol is reviewed, and attention is called to the fact that the samples of ergosterol used in the various investigations were from different sources and irradiated under poorly defined conditions of time, solvent, etc. It is suggested that the alleged harmfulness may be attributed to various causes, such as the action of the antirachitic factor itself, the action of the products of the transformation of ergosterol on prolonged irradiation, and alterations in the solvent itself during irradiation.

Experiments designed to determine the part played by these different factors are reported with the conclusion that, as far as mice are concerned, doses of irradiated ergosterol from 500 to 5,000 times the minimum active dose are without toxic effect, provided the product has undergone only the minimum of photochemical transformation compatible with maximum antirachitic effect. With a product irradiated to such an extent that the photochemical transformations have been pushed to their maximum without a marked increase in antirachitic activity, however, intestinal troubles may develop leading to death, at least with doses corresponding to 5,000 times the active dose. In such cases the modifications which the solvent undergoes are thought to play a prominent part.

Experimental hypervitaminosis in rats through large doses of irradiated ergosterol [trans. title], J. A. COLLAZO, P. RUBINO, and B. VARELA (*Biochem. Ztschr.*, 204 (1929), No. 4-6, pp. 347-353, figs. 3).—A dosage of 5 mg. daily of the commercial preparation of vitamin D, Vigantol, has been shown to produce in rats a condition of cachexia, loss in weight, inhibition of growth, lowering of the body temperature, and finally death. Photographs are included of rats suffering from such an excess of vitamin D, a condition named vitaminismus or experimental hypervitaminosis. Since the dosage was from 5,000 to 50,000 times

greater than the therapeutic dosage, the condition is considered to be improbable, but not impossible in human therapy. The effect of the over-dosage is thought to be one of stabilization of calcium in the tissues.

Vitamins as factors in health and in food values, II, H. C. SHERMAN ET AL. (*Amer. Jour. Pub. Health*, 19 (1929), No. 5, pp. 482-487).—This annual report of the committee on nutritional problems of the American Public Health Association (E. S. R., 59, p. 394) deals chiefly with the relationship of the water-soluble antipellagic factor of vitamin B (vitamin G) and of the quite dissimilar fat-soluble factor of Underhill and Mendel (E. S. R., 59, p. 394) to the theoretical and practical problem of the prevention of pellagra.

While the theoretical interpretation of the cure and prevention of pellagra is considered by the committee as still unsolved on account of these discrepancies in regard to the effectiveness of different articles of food, the practical problem is thought to be solved by the unanimity of opinion that milk and dairy products are especially effective as pellagra preventives.

Endemic goiter in Tennessee, R. OLESEN (*Pub. Health Rpts. [U. S.]*, 44 (1929), No. 15, pp. 865-897, figs. 5).—This survey, which was conducted according to the same plan as previous State-wide surveys (E. S. R., 58, p. 595), included 9,073 white boys, 11,120 white girls, 1,759 colored boys, and 3,196 colored girls attending the senior and junior high schools and upper grades of the grammar schools in 40 localities in the State.

Thyroid enlargement in varying degrees were noted in 9.5 per cent of the white boys and 23.5 per cent of the white girls, and in 15.4 per cent of the colored boys and 35.5 per cent of the colored girls, making a total of 4,876 enlargements of all degrees. The incidence was greater in the eastern than in the central or western portions of the State, but did not show any relationship to the source, treatment, or ultimate safety of the water or to geologic formations. A State-wide prophylaxis for goiter is not advised, but specific suggestions are given for guidance in dealing with the condition throughout the State.

TEXTILES AND CLOTHING

The effect of home and commercial laundering upon the wearing quality of gingham and similar fabrics and the reliability of the consumer's judgment in the selection of these fabrics, A. EPPLÉ and C. JOHNSON (*Missouri Sta. Bul.* 272 (1929), pp. 68, 69).—A group of 18 gingham and similar fabrics were laundered 45 times by home and commercial methods and were given textile tests after 5, 15, 30, and 45 launderings.

As measured by tensile strength the wear on gingham and similar fabrics was affected slightly by 45 launderings. The commercial method of laundering decreased the wear on gingham slightly less than the home method. Evidently the durability of fabrics can not be predicted accurately by tests on the unlaundered fabrics; consumers need more reliable methods for judging the wearing quality of gingham and similar fabrics.

HOME MANAGEMENT AND EQUIPMENT

A study of the oil burner as applied to domestic heating, A. H. SLENNER (*U. S. Dept. Agr., Tech. Bul.* 109 (1929), pp. 84, pls. 2, figs. 37).—This bulletin deals with the more technical phases of the investigations reported in Department Circular 405 (E. S. R., 56, p. 598).

The investigation of the vaporizing type of burner was restricted to a series of tests on the products of nine different manufacturers, all of which, while somewhat different in appearance, were essentially the simple casting type of

burner with the hot "spreader plate" which must be previously heated by means of a wick in order to produce the initial vaporization. The tests revealed not only that the efficiency of this type of burner was somewhat lower than that of the atomizing type, but also that there was a decided tendency, in the vaporizing burner, toward the production of soot.

The operating cost, even with satisfactory conditions otherwise, is somewhat higher than that of some atomizing burners.

The combustion efficiencies of the several representative atomizing burners tested were substantially the same. Ten per cent CO_2 in the flue gases was quite easily attained by the various burners, and, in fact, operation at this air-fuel ratio was used as a basis of comparison for the performance of the different burners, although higher percentages of CO_2 were obtained quite readily. As might be expected, there was some difference as to soot production, but in no case with the better atomizing burners, properly adjusted, could this difference be called significant.

The investigation as to the relative merits of the different grades of fuel revealed that the burners designed to use the heavier, cheaper fuels did so with efficiencies equal to those attained when the burners were supplied with the lighter fuels. The heavier fuels were burned with relative freedom from soot production. In intermittent operation the starting loss with the heavier fuels was quite as small as with the lighter fuels. Complete chemical and physical tests of the oils showed that the heavier oils, that is, the 28 to 32° distillates, should be quite satisfactory from the standpoint of viscosity, etc. There is no reason to believe that there will occur any clogging of lines with such oils under ordinary operating conditions, or any other undesirable effects which would require increased service.

The selection, for oil burning, of a boiler to supply a given radiation load is not necessarily safe if this selection is based upon similar ratings for burning coal. Aside from the possible differences in combustion characteristics of the two fuels, there is the additional fact that for intermittent operation of the oil-fired boiler, the actual instantaneous rate of heat emission is greater than for coal at the maximum.

With flat fuel rates the relative economy of oil heating, as compared with gas heating, increases with the increased size of the heating plant.

The effect of automatic control on over-all efficiency is important. With the high-low flame control of temperature, the furnace conditions as regards combustion are practically always favorable; that is, the temperature of the refractory or metallic combustion chamber is always sufficiently high to permit good catalytic effect.

With intermittent operation the conditions in the furnace may, as regards combustion, be relatively unfavorable after a long period of inactivity. However, if the temperature of the furnace walls does not fall below the critical temperature, the loss may be no greater than that which exists when equilibrium conditions are reached—that is, after the maximum temperatures have been attained.

The results of analyses of the stack gases at frequent intervals during the operation of starting showed that the CO_2 content for all practical considerations reaches its maximum value almost immediately. The starting loss really is in the form of unburned combustible as represented by the H_2 , the CO , and the unsaturated hydrocarbons identified by the formula C_xH_y .

The ordinary Orsat apparatus may not tell the whole story as to the constituents of the stack gases. This apparatus indicates the percentages of CO_2 , O_2 , CO , and N_2 by difference. If a heat balance is struck, assuming that only these gases are passing up the stack, it will frequently be learned that the unaccounted-for loss may be quite high, even after due allowance is made for

radiation. This difference has, from the tests reported on in this bulletin, been found to lie in heat units carried off by certain percentages of H_2 and $C_2 H_2$, illuminants, in addition to the CO. The Burrell Orsat has been employed for such analyses for the determination of these additional avenues of heat loss.

Cost of electricity for the home electric refrigerator, R. L. PATTY (*South Dakota Sta. Bul. 241* (1929), pp. 16, figs. 3).—Data are presented on the cost of electricity for home electric refrigerators, together with data on insulation and operation. Four refrigerators used an average of 379 kw. hours of electricity for one year, 3 of these being turned off during the winter. During the 3 warmest months of summer the refrigerators averaged a consumption of 77 kw. hours per month. During the 5 coolest months the average used was 43.6 kw. hours per month. The average temperature maintained by home electric refrigerators was 42.46° F., which was approximately 10° lower than the temperature maintained in ice boxes tested. An increase of 1° in the weather temperature for a week made the refrigerators under test use about $\frac{1}{2}$ kw. hour more electricity for the week. It was found that a favorable location for the refrigerator in the house saves some electricity.

MISCELLANEOUS

High points in work of Georgia Experiment Station, C. A. WHITTLE (*Georgia Sta. Bul. 156* (1929), pp. 31, figs. 27).—This bulletin, issued in commemoration of the opening of the Flynt Building (E. S. R., 61, p. 97), presents a brief account of the organization and work of the station.

Report of Moses Fell Annex Farm, Bedford, Indiana, June, 1929, H. J. REED and H. G. HALL (*Indiana Sta. Circ. 164* (1929), pp. 16, figs. 5).—The experimental work summarized in this report is for the most part abstracted elsewhere in this issue.

Fortieth Annual Report [of Mississippi Station], 1927, J. R. RICKS ET AL. (*Mississippi Sta. Rpt. 1927*, pp. 63).—This contains the organization list, a report of the director on the work of the station, a financial statement for the fiscal year ended June 30, 1927, and departmental reports, the experimental work in which is for the most part abstracted elsewhere in this issue.

How the experiment station solves farm problems: One year's work [at the Missouri Station, 1928], F. B. MUMFORD, S. B. SHIRKY, ET AL. (*Missouri Sta. Bul. 272* (1929), pp. 95, figs. 21).—This contains the organization list, a report on the work and publications of the station, and a financial statement for the Federal funds for the year ended June 30, 1928. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

Annual Report of [Nevada Station], 1928, [S. B. DOTEN] (*Nevada Sta. Rpt. 1928*, pp. 30).—This contains the organization list, a financial statement for the Federal funds for the fiscal year ended June 30, 1928, lists of station projects and publications, and a report of the director discussing the work and problems of the station during the year. The experimental work reported is for the most part abstracted elsewhere in this issue.

Work of the Newlands Field Station, Nevada, 1924–1927, E. W. KNIGHT (*U. S. Dept. Agr. Circ. 69* (1929), pp. 32, figs. 4).—The agricultural conditions on the project are described, meteorological data summarized, and the experimental work of the four years reported, as abstracted elsewhere in this issue.

Annual Report of [Porto Rico Insular Station, 1927], F. A. LÓPEZ DOMÍNGUEZ (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt. 1927*, pp. 38).—This contains the organization list and a report of the director for the fiscal year ended June 30, 1927, the experimental features of which are for the most part abstracted elsewhere in this issue.

NOTES

Montana College and Station.—Announcement is made of the retirement after 30 years' service in the State of R. A. Cooley as head of the college department of entomology, station entomologist, State entomologist, and secretary of the State Board of Entomology. He will continue as research professor of entomology and entomologist in the board of entomology, and this release from executive duties will enable him to devote more attention to the discovery of tick parasites in foreign countries and to their possible use in controlling the spotted fever tick in the Northwest, problems to which he has been giving special attention during the past two years. The new arrangement became effective January 1.

Leave of absence for graduate study at Harvard University and the University of Minnesota, respectively, has been granted to Sherman E. Johnson, assistant professor of agricultural economics and assistant agricultural economist, and LeRoy Powers, instructor in agronomy and assistant agronomist. M. L. Wilson, professor of agricultural economics and agricultural economist, has returned from leave of absence spent in the Union of Socialistic Soviet Republics as an adviser to that Government as to the feasibility of large scale farming in certain areas. S. G. Scott, assistant chemist in the station, resigned September 1, 1929, to accept a commercial position in Chile.

Minnesota University.—Belle O. Fish has been appointed specialist in child development.

Nebraska University.—Recent appointments include the following instructors: Crawford W. Nibler in dairy husbandry vice E. N. Hansen resigned, Homer E. Alder in poultry husbandry vice S. J. Marsden resigned, and Louise L. Leaton and May O. Mackintosh in home economics.

Wisconsin University and Station.—According to a note in *Wisconsin Country Magazine*, a State budget bill passed by the 1929 legislature requires the return to the general fund of the State each year of all unexpended balances from the State appropriations aside from those for land purchases and new construction.

Association of Official Agricultural Chemists.—The forty-fifth convention of this association was held in Washington, D. C., October 28-30, 1929, with a large and representative attendance.

The program followed the usual lines of recent years, although the serious illness of Dr. Harvey W. Wiley, honorary president, necessitated the omission of his customary address. The absence of Dr. Wiley was announced as his first in the entire history of the association.

The address of the retiring president, Dr. H. B. McDonnell of Maryland, dealt with studies carried on for five years at the University of Maryland on the use of low concentrations of ozone in the treatment of tuberculosis. In general, guinea pigs inoculated with the disease and given ozone in concentrations ranging from one part per million to one-tenth part per million showed little or no effects on either the animals or the disease in the weaker concentrations, while the stronger treatment seemed actually to shorten the guinea pigs' lives.

Officers were elected for the ensuing year as follows: President E. M. Bailey of Connecticut, vice president H. D. Haskins of Massachusetts, and secretary-treasurer W. W. Skinner, U. S. D. A. Bureau of Chemistry and Soils.

EXPERIMENT STATION RECORD

VOL. 62.

FEBRUARY, 1930

No. 2

From the point of view of research, the 1929 convention of the Association of Land-Grant Colleges and Universities was a much more important occasion than might have been anticipated from a casual examination of the program. Although no specific provision was made for the discussion of research questions in the general sessions, and but a single paper of this type was scheduled for the joint sessions of the section on agriculture, research was in no sense relegated to the meetings of those directly concerned with its up-building. References to its value and its need were frequent and significant, as in the appreciative indorsements by the Secretary of Agriculture and various members of the Federal Farm Board, and that these references were more or less incidental indicates chiefly that the status of research had become so well established and so thoroughly accepted as to render unnecessary the discussion of abstract principles.

On the other hand, the opportunities open for the consideration of specific problems were many and freely availed of. At the two sessions available for the subsection of experiment station work, such matters as cooperation in research, the interrelationships of the physical, biological, and social sciences, institutional policy as regards staff attendance on meetings, the acceptance of private funds and other relations with commercial enterprises, and the most effective means of disseminating the results of research were given detailed consideration through addresses, committee reports, and, to an unusual extent, discussions from the floor. Interest in most of these topics were keen and well sustained, and the sessions were generally regarded as notably enlightening and profitable.

Another encouraging development of the convention was the effective utilization by the section on home economics of an entire session for a discussion of the field of research in that subject. This was a considerably more generous apportionment of time than is customarily available in this section, and was important as an indication of an increasing recognition by administrative heads of home economics departments and divisions of responsibility for the development of research in this relatively uncultivated field of inquiry.

Unquestionably the address which dealt most broadly with research conceptions and ideals was that of Dr. A. F. Woods, Director of Scientific Work of the U. S. Department of Agriculture. This address was entitled Need for the Promotion of Fundamental Research and Correlation of Work in the Interest of Agriculture and the Mechanic Arts, and was mainly a plea for the encouragement of what has commonly been termed "pure science." Dr. Woods maintained that "the application of known facts to present needs has consumed so much of our energy and thought and has been so fruitful of beneficial results and holds out so much promise of immediate gain that we are inclined to neglect the pure science sources that made these applications possible." In his opinion, "the time has come when we must give careful thought to fundamental research if we are to insure progress and reap the full benefits that deeper and more accurate knowledge can give."

The applied side of research Dr. Woods believed to have been developed on a subject-matter basis fairly well, both in the Department of Agriculture and the experiment stations. As the two things on which emphasis is still needed, he named (1) the better organization and support of fundamental research and fundamental research contacts and (2) the better correlation of research, service, and extension work from the standpoint of the major agricultural industries. As a step in the direction of correlation, he explained briefly the plan being tested by the Department of organizing committees "representing all lines of work on each crop, functioning through the Director of Scientific Work and the chiefs of the bureaus involved, and frequently outside cooperating agencies, especially the experiment stations. . . . The committee method may not be the best way to accomplish this correlation. If not, some better way must be found."

Reference to some of these matters was also made in a paper by Dr. B. Youngblood of the Office of Experiment Stations, chairman of the cotton research coordination committee. Discussing the Relation of the Physical and Biological to the Social Sciences in Agricultural Research, Dr. Youngblood declared that "collective thought and concerted action on a more extensive nation-wide scale must supersede scattered efforts in the front-line offensive against major obstacles. Wherever tried, community of effort is yielding such significant results that it can not be ignored. The social science group is dealing with rather broad problems, neither so clear-cut nor delimited in scope as those ordinarily encountered in the physical and biological fields. To safeguard conclusions, therefore, projects in farm management, marketing, and rural life may often be carried to advantage in association with appropriate subject-matter departments. The subject-matter specialist can often contribute important

details to the projects of the social group. The agronomist, for example, should be the better authority on soils, variety of corn or other crops, cultural methods, and the like; the specialist in animal husbandry, on types of livestock, their feeding and care; whereas the farm economist should be the better judge of the economic relationships of soils, crops, livestock, and market prices, and types of farming. The farm economist in turn has much to contribute to the experimental work of the subject-matter specialist, in the form of economic viewpoints and broad perspectives of the larger needs of agriculture."

Dr. Youngblood cited numerous examples of successful blending of physical, biological, and social researches, and argued for the development of a type of research organization which will foster such relationships. "The basic unit of such an organization," he declared, "is the creative mind of the individual worker—referred to by a very explicit writer as the 'reasoning machine.' The next larger unit is the departmental group, and the next is the composite reasoning machine—an agricultural experiment station or a Federal bureau. For the most effective functioning of such a machine, two distinct types of mind are essential. The one is the creative mind of the individual worker, and the other is the 'engineering' mind of the responsible leader—the director or chief. The functions of the engineering mind are of no less importance than those of the individual minds which constitute the reasoning machine. Its function is to discover or develop creative minds for researches in the physical, biological, and social sciences and to blend them properly in the construction of the composite reasoning machine. Its further function is to inspect this composite reasoning machine at regular intervals and to keep it in a high state of repair and adjustment. Finally, it becomes the joint function of State and Federal leaders, through cooperation and the coordination of effort, to pool their resources for the construction of a giant reasoning machine—one big enough to cope successfully with the obstacles confronting American agriculture; to see that this giant machine operates smoothly; and to keep it constantly trained upon major objectives of national importance."

A more detailed analysis of the current status of cooperation and correlation was given in the report of the joint committee on projects and correlation of research, headed by Director F. B. Mumford of Missouri. This report showed that there are nearly 1,100 active cooperative projects between the stations themselves and the Department. An increase of about 200 projects was recorded over the previous year. All of the stations were represented, and in 6 cases by a number in excess of 35 projects each. Among them were 20 major regional projects, such as those dealing with the study of the quality

of meat, soft pork, corn improvement, oil sprays, spray residues, and the growth of wool. Attention was also called to a new project involving cooperation between specialists in home economics, rural sociology, and agricultural economics and entitled Rural Family Living: Content, Adequacy, and Conditioning Factors.

Although the committee found that "formal cooperation on the national projects, with an analysis of the subject and a division among investigators of the various things necessary to be done, has not made notable headway in most lines," other group contacts of various kinds have been on the increase. Meanwhile, it is pointed out, "a great movement has been set on foot to bring about cooperation in the agricultural industry. Already it is making the demand felt for more positive, safely applicable information on a great variety of subjects. The need is for well-rounded and coordinated knowledge in place of fragmentary information which must be summarized and interpreted before it can be used widely. The occasion presents an unusual challenge to the agencies relied upon to furnish the basis of progress in knowledge and understanding of agricultural problems."

Because of these things "the broader relationships of research are believed to merit the studious attention of directors in planning their programs and especially in inaugurating new projects or lines of work. Whether a subject in which there is regional or widespread interest shall be investigated independently and without due regard to what others are doing or to the general advancement of the subject assuredly is a matter for administrative consideration."

The discussion as regards home economics dealt with the point of view of research and the selection of adequately trained workers. It was opened by Miss Sybil L. Smith of the Office of Experiment Stations, who maintained that emphasis at the present time should be on a research point of view in home economics rather than on a home economics point of view in research. Taking her illustrations from the program of research in foods and nutrition which has been developed since the passage of the Purnell Act, she attempted to show that the greatest progress is taking place where the lines are not drawn too closely about home economics and its immediate point of view, and where cooperation is freely sought from and given to other departments as the need and opportunity may arise.

Three members of the Bureau of Home Economics, Miss Hildergarde Kneeland, Miss Ruth O'Brien, and Dr. Louise Stanley, continued the discussion with particular reference to the need for specialized training. All agreed that training in the fundamental sciences is very essential and that these sciences must be drawn

upon to supply many home economics workers. Dr. Stanley, however, argued for some contact or training in home economics. Where this is not available, she deemed it essential that if an adequate solution of the problem is to be expected, the studies be directed from the home economics point of view.

The principal paper at this session was given by Dean R. E. Buchanan of the Graduate School of the Iowa State College on Some Interrelationships of the Graduate School, Research, and Home Economics. Taking as his theme "there can be no research without researchers and the place for the training of researchers is in the graduate school," Dean Buchanan called attention to the increased demand for graduate work in home economics and pointed out certain weaknesses in the undergraduate curricula if preparation for graduate work is to be one of the major objectives. The most common defects, in his opinion, are in the requirements for foreign languages and mathematics. More care should be taken in the selection of personnel for the administration of graduate work, and the members of the staff should have the opportunity to carry on research themselves. A careful survey of each institution should be made to determine to what extent graduate work should be attempted, and in some cases it should be limited to one or two of the subject-matter divisions only.

The report of the committee on experiment station organization and policy, headed by Director J. T. Jardine of Oregon, dealt with two perennially perplexing problems, those of station travel and relationships with commercial enterprises and interests. One phase of the first-named subject, the question of staff attendance at national and regional meetings, was also considered in a paper by Director W. W. Burr of Nebraska, while the second received attention in a discussion of the relations of agricultural colleges to commercial agricultural workers by Director D. T. Gray of Arkansas.

Director Burr's paper, based on a survey of existing practices, indicated that while certain institutions have set up more or less definite rules as to staff attendance on meetings, there is no generally accepted policy for the group as a whole. The consensus of opinion is that participation in national or regional meetings is beneficial, but that the pressure for funds necessitates certain limitations. Attendance as an institutional representative is commonly accepted as warranting the payment of all expenses, but it is thought that the individual should bear a portion of the cost when he is to be personally benefited. A careful classification of meetings and conferences with reference to their importance to the institution is deemed very desirable.

The committee report likewise recognized that the matter is one for local determination, but laid down a number of general principles as likely to be helpful. It maintained that all official travel should be subject to administrative regulation and supervision and based on advance authorization. Annual allotments on a departmental basis were deplored, and it was suggested that when intelligently controlled in the interest of economy of time and funds, out-of-State travel may often be as necessary and as profitable as that within the State. It was pointed out that interruptions of work should be considered as well as the direct expense of travel, and that as to conferences the advantage to the station should be the main basis of decision. "Indefinite and ill-defined proposals for 'getting together,' 'to make contacts,' and 'to talk things over' deserve to be looked upon askance. Conferences, committee meetings, and constructive movements have an undoubted place in the advancement of research, particularly that which is cooperative or in collaboration with others, but to be profitable such gatherings need to be governed by a well considered plan and program, and without some form of follow-up they may lack permanent results. Many matters can be settled quite as satisfactorily by letter. Frequently, written proposals may receive more studious consideration than those presented for hasty conclusion in conference."

The second topic of direct administrative concern was that of commercial relationships. As was brought out in the paper by Director Gray, this problem is increasing in importance, though much more pressing in some States than in others. Thus far, it appears that in 31 States no general policy has been worked out, and that in none of those with a partial policy is complete satisfaction reported. Numerous advantages to some institutions have apparently followed their acceptance of aid from private agencies, such as earlier action on certain problems by the establishment of fellowships, the training of additional workers, the securing of much-needed appropriations, and the making of wider contacts, but not infrequently there have also developed more or less serious disadvantages. Among these are the possibility of misunderstandings on the part of the public if their representatives appear "arm in arm" with commercial interests, a more or less insidious temptation to certain workers to shape their activities with an eye to commercial offers, and the more common but nevertheless unfortunate impulse which is sometimes felt toward a one-sided and relatively unimportant program. Admitting as did Director Gray that industry is in the educational field to stay, the solution of the problem perhaps lies in an attitude of strict impartiality and a decision as

to specific projects on the single basis of the popular welfare. In any case, he concluded that the colleges must lead and not be led. Once their own program is set up, the assistance of certain commercial interests will frequently be helpful if properly safeguarded.

What these safeguards should be was well indicated by the committee on experiment station organization and policy, which reaffirmed its standard of the previous year that any privately-supported research must be of general importance and in the station's immediate field, that the cooperation should be strictly institutional and handled through the regular administrative channels, and that carefully worded project agreements safeguarding the public interests should be drawn. Results, it was set forth, should first be made public through the regular station channels whether favorable or unfavorable to the cooperating agency.

The special case of gratuities was also passed upon by the committee in the following language: "The acceptance of a gratuity, which in the case of individuals may vary from pigskin memorandum books to expenses for extensive travel, is contrary to the best interests of the station because prejudicial to its standing as a disinterested and public institution. On the other hand, gifts to the station of livestock, machinery, or materials may be properly received when their acceptance obviously will further worthy experimentation and demonstration. Each case, however, should be carefully considered on its merits."

Another sort of commercial relationship was taken up by Dr. C. R. Moulton in a paper entitled *The Experiment Station as a Training Ground for Industries*. It was Dr. Moulton's view that the commercial field in the future is to include many attractive opportunities for promising young men of research training and temperament, and will compete for their services with public agencies and private farming ventures. Such competition, he believed would on the whole be helpful to station research by enlarging both its opportunities and its rewards.

The relation of the experiment stations to the building industries formed the subject of a paper by Prof. Henry Giese. Prof. Giese is on leave of absence from the Iowa College and Station to serve as director of the advisory council on research in farm structures, authorized some months ago by the Secretary of Agriculture in response to a resolution from the American Society of Agricultural Engineers, and in this capacity has been conducting a survey of existing work in this field. In his opinion, unusual opportunity is presented for basic studies of such matters as ventilation, adaptability of materials, and the economic wisdom of low-cost structures. Already the survey has indicated that much of the data now being relied upon is empirical and inaccurate. What will be needed, in

his judgment, is a coordinating program, since most of the studies will involve the cooperation of several specialists, and the prosecution of a regional attack in many instances.

Despite the fact that few topics have appeared upon the convention program more frequently than that of the form and content of experiment station publications, its discussion again revealed an active interest in this important phase of station activity. Papers were given by a station editor of long experience, Prof. A. W. Hopkins of Wisconsin, and an extension director, Prof. C. F. Monroe of North Dakota, and their suggestions were made primarily from their respective points of view. In spite of marked improvements in recent years, Prof. Hopkins found on inquiry among station editors a preponderance of belief that many research publications are still needlessly bulky, often containing much detailed data the publication of which might well be dispensed with. In his opinion, the preparing of an outline to be submitted to the director before the writing of a bulletin is attempted would often prove very helpful. A second suggestion was that some duplication of certain types of informational publication might be avoided by purchases of bulletins from other institutions.

Director Monroe argued for a restricted distribution of technical publications and the substitution of interpretive popular summaries for general use. Oftentimes, he declared, investigators might make more definite and constructive recommendations as a result of their work. Since the final end sought in much station experimentation is its application in farm practice, the responsibility of the investigator does not cease till he has made it clear just what has been learned from the inquiry and what its significance may be.

Some differences of opinion were revealed in the discussions of these and other questions, and it is evident that in not a few cases conditions vary so widely and change so often that hard-and-fast decisions are neither likely nor desirable. One of the great merits of the system of State experiment stations has always been its flexibility, and it is worth while to reflect that adaptability is frequently better than standardization. None the less it is very important that the several institutions be informed as to the experiences of others and so be in a position to select for themselves the best methods and the soundest policies which have so far been made known. This function of a clearing house of ideas is well served by the association subsection of experiment station work as now constituted. The relatively large amount of time available for this subsection under the latest plan of apportionment gives opportunities for even greater helpfulness in this direction, and it is encouraging to note that this opportunity is being more and more appreciated.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

The composition of California walnut oil, G. S. JAMIESON and R. S. MCKINNEY (*Oil and Fat Indus.*, 6 (1929). No. 2, pp. 21-23).—It is noted that walnut oil manufacture is one of the minor industries of California, the broken or imperfect kernels of *Juglans regia*, a product containing about 50 per cent of oil, being used as raw material for a present annual production of about 250 tons of oil and of a press cake used as a feed for cattle and poultry.

The crude oil is used largely for the manufacture of soap, somewhat for paint making, for which it is suitable because of its good drying qualities and capacity to form a paint film less subject to cracking than is the linseed oil film. When refined the product is suitable for use as an edible oil.

In the discussion of the chemical and physical characteristics of California walnut oil it is pointed out that this product appears to have an iodine number averaging distinctly higher than that of European walnut oil.

The percentages of saturated and of unsaturated fatty acids were determined by the lead-salt-ether method, and the results were corrected for the small quantity of unsaturated acids precipitated and weighed with the saturated acid fraction, as well as for the unsaponifiable matter remaining in the unsaturated acid fraction. The following chemical and physical characteristics were found for the sample investigated: Sp. gr. 25/25° 0.9235, refractive index at 25° 1.4751, acid value 5.11, iodine number (Hanus) 158.5, iodine number (Wijs) 161.7, saponification value 194.5, acetyl value 6.09, Reichert-Meißl value 0.11, Polenske number 0.19, hexabromide 8.58 per cent, unsaponifiable matter 0.51 per cent, saturated acids (corrected) 5.34 per cent, unsaturated acid (corrected) 89.74 per cent, and iodine number of unsaturated acids 166.7.

Of the 89.74 per cent total of the unsaturated acids, linolenic acid was found to constitute 3.08, linolic acid 69.75, and oleic acid 16.91 per cent. Of saturated acids there were isolated 0.01 per cent of myristic acid, 4.40 of palmitic acid, 0.92 of stearic acid, and 0.01 per cent of arachidic acid. The unsaponifiable matter was found to amount to 0.5 per cent.

In addition to the data noted and the percentages of the glycerides as calculated for the figures given for the individual acids, an account is given of the preparation and distillation of the methyl esters of the saturated acids and of the methods used in the examination of the six fractions separated for the detection and isolation of the individual members of the group.

The control of reaction in cultures and enzymic digests, F. W. FOREMAN and G. S. GRAHAM-SMITH (*[Gt. Brit.] Dept. Sci. and Indus. Research, Food Invest., Spec. Rpt. 32* (1928), pp. III+27, figs. 11).—The opinion is stated that in meat extract media the buffer effect is in large measure due to phosphates and to creatinine, with "any substances possessing similar titration properties which might be present." It is noted that whereas the titration curve region of most effective buffering extends for the phosphates approximately from pH 7.2 to pH 6.3, the corresponding figures for the creatinine run approximately from

pH 5 to pH 4.5. "Calculated in terms of their titration values with HCl from about pH 9 to 4, the quantities of inorganic phosphates and 'creatinine' (including any substances possessing similar titration properties which might be present) in the concentrated ox heart extract were in the proportion of about 1.7 to 3.0. Broadly speaking, the other constituents collectively play a very minor part in the buffering of added acid between the pH limits mentioned.

"Attempts made to associate the behavior of the phosphates and creatinine with the pH and acidity values of the culture as the incubation proceeded did not give rise to any definite conclusions, more particularly in regard to the important early period of about 10 days when the amplitude of the pH fluctuations was very small and the pH values lay between the flat regions of the phosphates and creatinine titration curves."

A large number of further experimental observations bearing more or less closely upon the buffer properties of the media in question and upon the control of the reaction of such preparations are detailed and discussed, however.

"In order to avoid confusion it seems desirable to use another term in reference to resistance to change of $[H^+]$. Having regard to the depressing action of the salt upon the dissociation of the free acid . . . the term 'depressor effect' is employed."

The changes produced in meat extracts by the bacterium *Staphylococcus aureus*, F. W. FOREMAN and G. S. GRAHAM-SMITH ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Food Invest., Spec. Rpt. 31* (1928), pp. III+97, figs. 12).—The medium used was a plain water extract of ox heart, neither neutralized with soda nor containing such additional substances as peptone or salt, but for the most complete and extended of these experiments concentrated to one-fourth or to one-tenth of its original volume. The observations here recorded were made upon cultures incubated at 37° C., in an apparatus designed to prevent either evaporation or contamination during the taking of samples.

A growth curve having peaks at the fourth and the twenty-eighth day was recorded, and concurrent with the growth peaks were two periods of important chemical change. During the first rapid growth period there were noted three phases of chemical alteration, (1) the production of volatile bases alone; (2) the production, beginning before the completion of the first phase, of volatile and nonvolatile acid radicals in approximately equal proportions; and (3) the production of nonvolatile acid radicals alone. From the fact that the alcohol titration values remained practically constant during the first phase, it is concluded that no appreciable development of acids takes place at this stage; and since the amino acid figures remained unaltered during this first phase of the reactions induced by the organism studied, this group of compounds is considered not to have been the source of the volatile bases. The free acid content of the culture decreased during the base-production phase, increased during the second, and reached a maximum during the third phase of the reactions accompanying the first rapid growth period.

In the second growth period, reaching its peak at about the twenty-eighth day, the principal type of chemical reaction recorded was that of the conversion on nonvolatile acid radicals, other than those of amino acids, into equivalent quantities of volatile acids. "The quantitative conversion is confirmed by the fact that the alcohol titration value is practically constant during the whole of this period." At the second growth peak "the process has been completed, the content of volatile acids has reached its maximum, and the content of non-volatile acid radicals has sunk to a low level."

A total increase of 23 per cent in the inorganic phosphorus content at the expense of the organic was noted in the first seven days of incubation, crystals

of magnesium ammonium phosphate having been observed to separate in the culture.

In a third growth period following the second growth peak the nonvolatile acid radicals were found to be reduced nearly to zero, the volatile acids remaining, however, at the high level attained at the end of the second growth period. The decline in the content of nonvolatile acid radicals was accompanied by a corresponding decline in the total alcohol titration value and in the net acidity of the alcohol extract, from which observation was drawn the conclusion that "the product of the destruction of these remaining nonvolatile acid radicals was carbon dioxide which escaped."

"A fourth period of change was discovered by investigating a similar culture . . . incubated for 344 days at room temperature, in which the changes had been carried . . . a stage further than that reached at the end of the third period. . . . Apparently about half the volatile acid radicals present at the end of the third period of growth had been destroyed with the production of carbonic acid found in the culture as bicarbonates of amines."

In addition to the experimental work upon which are based the statements noted, a rather extensive investigation was made of the existing methods for the determinations required, with the result that a considerable number of modifications was found necessary.

Iron studies. D. DICKINS (*Mississippi Sta. Rpt. 1928*, pp. 31, 32).—In this progress report it is stated that a comparison by O. Sheets and E. Frazier of various methods of determining small amounts of iron in vegetable tissues (collards and spinach) has led to the adoption of the Kennedy method¹ as the most satisfactory for use with such materials. The Walker method (E. S. R., 55, p. 12) proved unsatisfactory, the Lyons colorimetric procedure with thioglycolic acid (E. S. R., 58, p. 714) satisfactory for dry ashing but not for wet, and the potassium permanganate satisfactory for large but not for small amounts of material.

Test for vitamin-A in margarine, butter, and other fatty foods. A. ANDERSEN and E. NIGHTINGALE (*Jour. Soc. Chem. Indus. Trans.*, 48 (1929), No. 24, pp. 139T, 140T).—The test described consists in applying the antimony trichloride color reaction to a chloroform solution of the extractable unsaponifiable fraction of the material to be tested. The technic for the preparation of the unsaponifiable fraction is described in detail. It was found necessary to dilute the chloroform solution to such a point that the blue color with antimony trichloride is just perceptible.

It is stated that "hundreds of tests have confirmed the accuracy of the method from a comparative viewpoint. In addition, many duplicate tests have been made by independent laboratories, and in all cases very reasonable agreement has been obtained. That it is reliable when compared with feeding tests on experimental animals, under the strictly defined conditions now adopted for such tests, has been confirmed by numerous biological tests. The vitamin potencies determined by it have been in satisfactory agreement with the results obtained in the biological tests conducted by the pharmacological laboratories of the Pharmaceutical Society and by other highly qualified observers."

Comparison of biological and colorimetric assays for vitamin A as applied to fish oils. E. R. NORRIS and I. S. DANIELSON (*Jour. Biol. Chem.*, 83 (1929), No. 2, pp. 469-475, figs. 2).—This paper reports a study of the antimony trichloride color reaction of six fish body and liver oils and the relationship of the values obtained in this reaction with the Sherman-Munsell vitamin A units for the same oils. A modified technic for the color determination is described, the essential feature of which is cooling the chloroform solution of

¹ *Jour. Biol. Chem.*, 74 (1927), No. 2, pp. 385-391, fig. 1.

the antimony trichloride to the temperature of ice water and allowing it to remain at that temperature until equilibrium is reached. At this point a clear solution is obtained containing about 18 per cent of antimony trichloride. A series of dilutions of cod-liver oils, ratfish liver oil, and Chinook, sockeye, silver, and humpback salmon body oils in chloroform was prepared, and the color produced when 0.3 cc. of each dilution was mixed with 3 cc. of the reagent was measured in the Lovibond tintometer in the usual manner.

On plotting the intensities of the colors produced against the milligrams of oil used in the reaction, smooth curves were obtained but in no case was the color produced directly proportional to the vitamin A content. Only at low values did the curves approach straight lines. By interpolation the color value equivalent to 1 animal unit of the cod-liver oil (0.00099 gm.) was found to be 2.18 Lovibond blue units. The amount of other oils necessary to give the same color may be determined by similar interpolations or by plotting the lower values on a larger scale against the amount of oil used in the determination. As thus calculated, the values of the oils under examination were found to agree fairly closely with those obtained by feeding experiments.

Cod-liver oil and the antimony trichloride reaction for vitamin A. P. B. HAWK (*Science*, 69 (1929), No. 1761, p. 200).—The author questions the validity of the antimony trichloride color test for vitamin A on the basis of the observation that cod-liver oil which had been exposed to air and light gave a deeper blue color than the original oil or oils kept in the dark.

The antimony trichloride reaction of cod-liver oils [trans. title], H. von EULER, M. RYDBOM, and H. HELLSTRÖM (*Biochem. Ztschr.*, 208 (1929), No. 1-3, pp. 73-78, figs. 2).—The authors have subjected Norwegian cod-liver oil to two extractions with 96 per cent alcohol and tested the residue and extracts for vitamin A by the antimony trichloride color reaction. The oil obtained by extraction gave about four times as strong a color reaction as the original oil, and the absorption spectra of the blue solution resulting from the antimony trichloride reaction showed a much stronger absorption band than the residue.

Limitations of the antimony trichloride test for quantitative estimation of vitamin A. W. S. JONES, A. E. BRIDG. S. ARZOOMANIAN, and W. G. CHRISTIANSEN (*Jour. Amer. Pharm. Assoc.*, 18 (1929), No. 3, pp. 253-256, fig. 1).—A comparison of the antimony trichloride color test and the biological test for vitamin A is reported for varying dilutions of a representative European cod-liver oil and one of American cod-liver oil and for two series of cod-liver oils of unknown origin. In the diluted oils consistent results were obtained by both methods, but this was not the case with the oils of unknown origin. The value of the latter comparison is vitiated somewhat by the fact that the colorimetric tests were made from 6 to 9 months after the biological tests.

The composition of wool fat. J. C. DRUMMOND and L. C. BAKER (*Jour. Soc. Chem. Indus., Trans.*, 48 (1929), No. 32, pp. 232T-238T).—Of interest in this chemical investigation of wool fat is the reported failure to demonstrate the presence of ergosterol in the unsaponifiable matter through feeding experiments with the material after suitable irradiation. The absence of ergosterol was also confirmed by spectrographic examination of the material by R. A. Morton. These results are deemed somewhat surprising in view of the statement of Hess, Weinstock, and Helman (*E. S. R.*, 53, p. 563) that irradiated lanolin has antirachitic properties.

The biochemistry of the carotinoids [trans. title], B. and H. von EULER and P. KARRER (*Helvetica Chim. Acta*, 12 (1929), No. 2, pp. 278-285, figs. 2).—Various carotinoids were tested for vitamin A by animal feeding experiments and by the antimony trichloride color test. All of the materials tested, including lycopin, xanthophyll, bixin, capsanthin, γ -crocin, and dihydro- α -crocin,

gave blue colors of varying intensity with antimony trichloride. In the biological tests negative results were obtained with everything but carotin, which was effective in daily doses of 0.01 mg., and dihydro- α -crocin 0.015 mg. The livers of rats receiving carotin were found to have a carotinoid content equivalent to from 19 to 29 Lovibond units per gram of fresh liver as compared with from 25 to 35 units for livers of rats on a mixed diet.

Note on the absorption spectrum of vitamin A. O. ROSENHEIM and T. A. WEBSTER (*Biochem. Jour.*, 23 (1929), No. 4, p. 633).—The claim made by Morton and Heilbron (*E. S. R.*, 60, p. 689) and others that vitamin A is characterized by selective absorption in the ultra-violet region at about 320 to 328 μ has been tested by preparing from ergosterol dehydroergosterol, a substance which shows intense absorption in the same region as that claimed for vitamin A, and testing it for vitamin A by administering it in olive oil to rats on a vitamin A-free diet, with vitamin D supplied by irradiated ergosterol. No evidence of vitamin A activity was observed with doses varying from 0.001 to 1 mg. per diem. The peroxide and acetate proved equally inactive, and none of the substances gave the blue color with antimony trichloride. "It would seem, therefore, that selective ultra-violet absorption at 320–328 μ , at any rate by itself, can not be taken as a criterion of vitamin A."

The effect of pH control in the autoclaving of yeast with respect to the vitamin B factors. R. R. WILLIAMS, R. E. WATERMAN, and S. GURIN (*Jour. Biol. Chem.*, 83 (1929), No. 2, pp. 321–330, figs. 3).—Irregularities in results in the use of autoclaved yeast as a source of vitamin B₂ (G) free from B₁ (F) have led to an investigation of the factors influencing the destruction of vitamin B₁ by autoclaving. The method of autoclaving consisted in spreading fresh brewery yeast in shallow pans provided with covers and autoclaving it for 6 hours at 15 lbs. pressure in a sterilizer provided with automatic pressure control. The yeast was then air-dried before a fan and ground.

Tests for vitamins B₁ and B₂ in various lots of yeast thus autoclaved showed that the yeast contained variable but significant amounts of vitamin B₁, and that vitamin B₂ had been destroyed to an extent varying with the different lots. On altering the H-ion concentration of the moist yeast from strongly acid (pH 1 to 2) to strongly alkaline (pH 12 to 14) and autoclaving as before, it was found that vitamin F could not be completely destroyed except at a pH in excess of 4.5, the normal reaction of brewery yeast. The complete removal of vitamin B₁ was always accompanied by serious losses in vitamin B₂. Fresh bakers' yeast, pH 5.5 to 6.5, gave on autoclaving a product practically free from B₁ but low in B₂.

Heat and ultra-violet irradiation as means of differentiating vitamins B and G in yeast. C. KENNEDY and L. S. PALMER (*Jour. Biol. Chem.*, 83 (1929), No. 3, pp. 493–496, fig. 1).—Using the laboratory technic and methods for the preparation of food materials described in a previous paper (*E. S. R.*, 58, p. 192), the authors have been unable to substantiate the results of Hogan and Hunter (*E. S. R.*, 60, p. 293) that irradiation destroys vitamin G but not the antineuritic vitamin. In their experience irradiation destroys in varying degrees both of these vitamins and consequently can not be relied upon to obtain vitamin G uncontaminated by the antineuritic vitamin.

The chemical detection of vitamin C [trans. title], B. GLASSMANN and A. POSNER (*Ztschr. Untersuch. Lebensmit.*, 57 (1929), No. 2–3, pp. 191–200).—An extensive examination of the reliability of the Bexsonoff color test for vitamin C (*E. S. R.*, 56, p. 12) is reported, with the conclusion that the test is of no value since the phosphomolybdotungstic reagent acts with the tannins present in plant substances at ordinary temperatures and with carbohydrates and other plant substances at 100° C. A more or less quantitative relation-

ship was found between the color produced and the carbohydrate concentration of vitamin containing juices, while tannic acid gave a color which could be matched accurately with that produced with the standard solution of hydroquinone.

The absorption spectrum of vitamin D, R. B. BOURDILLON, C. FISCHMANN, R. G. C. JENKINS, and T. A. WEBSTER (*Roy. Soc. [London], Proc., Ser. B*, 104 (1929), No. B 733, pp. 561-583, pl. 1, figs. 7).—The hypothesis advanced in previous papers (E. S. R., 61, p. 392), that of the products formed on successive irradiation of ergosterol the one having maximum absorption at 280μ is vitamin D, has been put to various tests involving comparisons of the absorption spectra and antirachitic activity of various products of irradiation. "It is concluded that three substances (or groups of substances) are produced in succession, of which the first shows an absorption band roughly similar to that of ergosterol (maximum 280μ), but more than twice as intense. This absorption is accompanied by great antirachitic activity, and evidence is given showing that the substance concerned is probably vitamin D. The second product, which is formed by further radiation of the first, shows a strong absorption band with maximum at 240μ and has no antirachitic activity. The third substance is formed by further radiation of the second, and shows neither antirachitic activity nor marked absorption."

A chemical reaction for the antirachitic vitamin [trans. title], W. STOELTZNER (*München. Med. Wchnschr.*, 75 (1928), No. 37, p. 1584).—The author states briefly that phosphorus pentoxide gives with Vigantol oil, a 1 per cent solution of Vigantol in olive oil, a reddish brown color which turns dark on standing. The color reaction is given with cod-liver oil, but not with olive oil either alone or with nonirradiated cholesterol. On the basis of this evidence it is concluded that phosphorus pentoxide gives a specific color reaction with vitamin D.

METEOROLOGY

The measurement of evaporation in freezing weather, B. E. LIVINGSTON and F. W. HAASIS (*Jour. Ecology*, 17 (1929), No. 2, pp. 315-328, pl. 1).—An air pocket provided by inserting in the porous-porcelain sphere of an atmometer a piece of air-filled flexible rubber tubing with closed ends was found to prevent injury to the bulb as a result of freezing, but it is pointed out that "readings for periods when freezing occurs are not to be considered as homogeneous with those for other periods, no matter whether frost injury is observed or not."

The distribution of the average seasonal rainfall over Europe, J. GLASSPOOLE (*Quart. Jour. Roy. Met. Soc. [London]*, 55 (1929), No. 229, pp. 55-71, figs. 9).—Data for 650 stations, of which 200 are in the British Isles, were used in the preparation of maps showing the distribution of rainfall over the British Isles and central Europe. These show that "in no part of Europe is the precipitation uniformly distributed among the seasons. The average fall of the various seasons does not vary markedly in parts of the Central Plain and in the British Isles, but along the southern fringe of Europe the summer is practically rainless. . . . The fall of the winter half-year in the British Isles is everywhere greater than that of the summer except in three small areas along the east coast, where the summer fall is slightly greater. . . . Over the Continent the winter fall exceeds that of the summer in two well-marked areas, viz, to the west of a line from northern Norway to the western Pyrenees and to the south of a line roughly from the mouth of the Rhone to the Crimea."

Correlation of plant growth with weather types [trans. title], E. E. FENOSOV (*Nauch. Agrom. Zhur. (Jour. Landw. Wiss.)*, 4 (1927), No. 7-8, pp. 429-438; *Rus. abs.*, pp. 437, 438).—This article discusses results of studies with rye

from 1886 to 1919, inclusive, at the phenological observatory at Sirotkino, near Moscow. It supplements one previously noted (E. S. R., 60, p. 616), and indicates that a mean daily temperature of about 20° C. with a diurnal amplitude of 10° or more and a mean daily humidity of from 41 to 60 per cent are especially favorable to the growth of rye if not accompanied by droughts.

Weather reports, H. W. ALBERTS ET AL. (*Alaska Stas. Rpt. 1928*, pp. 3, 10, 17, 18, 31-39).—Seasonal weather conditions at the Sitka, Fairbanks, and Matanuska Stations and monthly summaries of observations at 32 meteorological stations for 1928 are reported.

The season of 1928 at the Sitka Station "was cool and wet during the growing period, which extended from May to September, inclusive. The mean temperature for the period was 51.8° F., and the total precipitation, 27.1 in. There were 14 clear days, 59 partly cloudy days, and 80 cloudy days during the growing season. The last killing frost in the spring occurred May 26, and the first killing frost in the fall October 8, which gave a frost-free period of 135 days."

The season of 1928 at the Fairbanks Station as a whole was favorable for crop production. "The last killing frost in the spring occurred May 30, and the first killing frost in the fall occurred September 3. This gave a frost-free period of 95 days, which is 5.4 days below the average. Killing frosts occurred in a few low areas July 21 and 22. The summer was cool, and there were many cloudy days. However, the frequent rains during the greater part of the growing season and the many hours of daylight caused a remarkable growth of all adapted crops. The maximum temperature of 88° occurred in June. The total precipitation for the year was 8.9 in., 3.9 of which fell during the growing season."

At the Matanuska Station "the season was favorable for growing peas and vetch for hay and silage, but was too short to permit ripening of the seed of these crops. The late varieties of cereal grains and potatoes failed to mature."

Meteorological observations, [July-August, 1929], C. I. GUNNESS and D. F. MURPHY (*Massachusetts Sta. Met. Ser. Buls. 487-488 (1929)*, pp. 4 each).—The usual summaries and notes are given of observations at Amherst, Mass., during July and August, 1929.

SOILS—FERTILIZERS

[Soil Survey Reports, 1923 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1923, Nos. [44], pp. 1505-1555, fig. 1, map 1; 45, pp. 1557-1599, fig. 1, map 1; 46, pp. 1601-1648, fig. 1, map 1*).—Of the three surveys here noted, one was conducted in cooperation with the University of Nebraska and two in cooperation with the New York State College of Agriculture.

No. 44. *Soil survey of Webster County, Nebraska*, L. A. Wolfanger and R. D. Wood.—Webster County, on the southern boundary of Nebraska, has an area of 366,720 acres of lands assigned to the Prairie Plains Province, the originally level plain having been dissected in this county by the Republican River and its tributaries which, with the Little Blue River, forms a generally adequate drainage system for the county.

Holdrege silt loam, in the form of a rolling phase occupying 86.6 per cent of the total area of the county, is the most extensive type, Crete silt loam and Hastings silt loam following with 21.6 and 20.8 per cent, respectively. In all, 20 types were found in Webster County and are here mapped and described as members of 14 series, with 2 per cent of rough stony lands.

No. 45. *Soil survey of Columbia county, New York*, H. G. Lewis and D. F. Kinsman.—Columbia County, southeastern New York State, possesses an area of 408,320 acres. Physiographically, the lands of Columbia County include parts of the western range of the Taconic Mountains and of the eastern section of the Hudson lowland. The greater part of the combined areas is of a surface gently rolling or undulating to moderately hilly, and for the most part well drained.

The soil series of Columbia County were found to number 21, represented by 37 types of which Dutchess loam, 12.3 per cent, and Dutchess slate loam 13.2 per cent, were found to possess the largest areal extent. Areas amounting in all to 13.9 per cent and supporting principally a timber growth are designated rough stony land and are listed unclassified, together with very small areas of other miscellaneous materials.

No. 46. *Soil survey of Herkimer County area, New York*, H. G. Lewis et al.—Herkimer County is located in east-central New York. The area of which the survey is here reported comprises approximately the southern half of the county and includes lands amounting to 460,800 acres of a dissected plain traversed by the valley of the Mohawk River. Drainage is provided by the Hudson River through the Mohawk River and, in the southernmost part of the area, by a part of the Susquehanna River system.

Of the 39 soil types found in the Herkimer County area and here mapped and described as 27 series, Mohawk silt loam, 10 per cent, has the largest individual aggregate surface. The groups of miscellaneous soils of areal importance are 10 per cent of rough stony lands and 6.4 per cent of steep broken lands, "best suited to use for forestry."

[Soil Survey Reports, 1924 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1924, Nos. 24, pp. 63, pl. 1, fig. 1, map 1; 25, pp. 72, pls. 2, fig. 1, maps 2; 27, pp. 27, fig. 1, map 1; 28, pp. 30, fig. 1, map 1*).—Four surveys are noted, No. 24 in cooperation with the California Experiment Station, No. 25 in cooperation with the Oregon Experiment Station, and Nos. 27 and 28 in cooperation with the Michigan Experiment Station and Department of Conservation.

No. 24. *Soil survey of King City area, California*. E. J. Carpenter et al.—The King City area, in the southern part of Monterey County, Calif., has an area of 769,280 acres of lands possessing a widely varying topography and provided with well-developed drainage.

The agricultural part of the King City area was found to include 36 types of soils belonging to 17 series, together with rough broken and stony land, 49.3 per cent, utilized for grazing. Kettleman loam, 6 per cent of the area surveyed, is the most extensive individual type.

No. 25. *Soil survey of Linn County, Oregon*, A. E. Kocher et al.—Linn County, west-central Oregon, contains 977,920 acres of lands ranging in surface features from smooth through rolling to hilly and mountainous. The drainage of the county is provided in the main by the Willamette River and its tributaries. Rough mountainous land, 36.7 per cent, principally in timber, constitutes the largest part of the area. Olympic clay loam, 12.5 per cent, is the most extensive of 31 classified types of soil found in the county, followed by Dayton silt loam, 9.1 per cent.

No. 27. *Soil survey of Roscommon County, Michigan*, J. O. Veatch et al.—Roscommon County is located in the north-central part of the Lower Peninsula and possesses a land area of 328,320 acres of a general surface nearly level to gently undulating, with some more hilly or rolling land. The principal soils among the 14 series of 17 types here mapped and described are, from the

point of view of areal extent, Roselawn sand 19.3 per cent, Rifle peat 19.1 per cent, and Grayling sand 16.9 per cent.

No. 23. *Soil survey of Alpena County, Michigan*, R. Wildermuth et al.—Alpena County includes 359,680 acres in the northeastern part of the Michigan Lower Peninsula and possesses topographic features characteristic of the glaciated region. Onaway loam, 12.8 per cent of the total area of the county, is the most extensive of 23 types of 21 series of soils, followed by Rifle peat with 12.3 per cent.

[*Soil Survey Reports, 1925 Series*] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.], Ser. 1925, Nos. 7, pp. 31, fig. 1, map 1; 8, pp. 31, fig. 1, map 1; 9, pp. 48, fig. 1, map 1*).—Of the three surveys here cited, Nos. 7 and 8 were conducted in cooperation with the Arkansas Experiment Station and No. 9 in cooperation with the North Carolina Department of Agriculture and Experiment Station.

No. 7. *Soil survey of Bradley County, Arkansas*, E. B. Deeter et al.—Bradley County consists of 413,440 acres in southeastern Arkansas, distributed between three main stream systems as wide undulating to flat areas of deficient natural drainage.

Caddo fine sandy loam, ill drained and "very strongly acid," and overlying a clay subsoil, occupies 22 per cent of Bradley County, and Caddo very fine sandy loam, similar in acidity and poor drainage to the first-named type, covers 19.3 per cent of the county. Altogether 23 types are mapped and described as 13 series.

No. 8. *Soil survey of Nevada County, Arkansas*, W. I. Watkins et al.—Nevada County, southwestern Arkansas, consists of a flat to steeply rolling area of 396,800 acres, drained by poorly developed stream channels subject to overflows, "caused during rainy periods by obstructions of brush, logs, and cypress knees." Surface drainage is mainly satisfactory, however, "except in seeped areas and on broad terraces along the Little Missouri River."

The soils mapped are classed in 20 series inclusive of 32 types, of which Ruston fine sandy loam, with a relatively very small smooth phase, covers 25.2 per cent of the county, followed by Kirvin fine sandy loam 11 per cent, and Bibb very fine sandy loam 10.8 per cent. Of the last-named type it is noted that "practically none of this soil is under cultivation owing to the poor drainage."

No. 9. *Soil survey of Northampton County, North Carolina*, W. D. Lee and S. F. Davidson.—Northampton County has an area of 346,240 acres in the northeastern part of the State, lies almost entirely in the Coastal Plain region, with a small northwestern projection into the Piedmont Plateau in which a relatively very small part of the county surface is strongly rolling to hilly. The county has a topography throughout the major portion of the area ranging from flat to rolling, while the drainage provided by the Meherrin and Roanoke Rivers is, in the southern part of the county, "not so well established as in the northern and western parts."

Norfolk fine sandy loam, 10.2 per cent of the entire area surveyed, is the most extensive among the 36 classified types here assigned to 20 series. Among unclassified materials there were found 0.7 per cent of meadow and 7.6 per cent of swamp.

Soil survey of Quitman County, Georgia, R. E. DEVEREUX and E. D. FOWLER (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.], Ser. 1926, No. 1, pp. 23, fig. 1, map 1*).—The county surveyed is a nearly flat to badly broken and eroded area of 109,440 acres in southwest Georgia, the drainage ranging from excessive to poor.

The soils are classified in 9 series of 14 types together with an extensive area of unclassifiable lands. In order of areal extent the groups listed are unclassifiable lands (15.4 per cent of rough gullied land, 7.3 per cent of meadow, and 3.6 per cent of swamp) totaling 263 per cent of the entire county; Greenville sandy loam 21.1 per cent; and Ruston sandy loam 19.6 per cent.

The survey was conducted in cooperation with the Georgia State College of Agriculture.

Coles County soils, R. S. SMITH, E. E. DETURK, F. C. BAUER, and L. H. SMITH (*Illinois Sta. Soil Rpt. 44* (1929), pp. [2]+61, pls. 2, figs. 10).—Coles County, Ill., is located in the east-central part of the State and possesses 325,658 acres of soils formed from glacial material, presenting surface features from level or gently undulating through gently rolling to strongly rolling.

The soils of Coles County are mapped and described in four groups, of which the upland prairie soils constitute 61.57 and the upland timber soils 32.35 per cent. Of individual types a brown silt loam of the upland prairie group, a yellow-gray silt loam of the upland timber group, and a black clay loam of the upland prairie group cover 42.08, 26.4, and 17.15 per cent of the total area, respectively.

In addition to the data and descriptive matter directly connected with the soil survey the report contains the usual appendix taking up the interpretation of the soil survey and the principles of soil fertility, and a supplement in which are presented results of soil and fertilizer experiments on eight experimental fields.

Microbiological investigation on the virgin and arable volcanic soils from Sakura-jima, Japan, A. ITANO and S. ARAKAWA (*Ber. Ōhara Inst. Landw. Forsch.*, 4 (1929), No. 1, pp. 27-33, pl. 1, fig. 1).—Sakurajima is a volcanic island in the Bay of Kagoshima, Kyushu, Japan, the entire island consisting of a conical mountain with a limited arable area near the shore.

A description of seven samples of the soils of the island is given, together with the moisture content, water-holding capacity, specific gravity, loss on ignition, pH value, and quantitative and qualitative microbiological analyses. The chromogenic group of the colonies of organisms obtained and the morphological character of the bacteria isolated are also stated.

It was found that in the 14 years following the most recent eruption of the volcano a general soil population has already appeared, with autotrophic organisms in the majority. Of 84 strains isolated the greater proportion were micrococci or short rods, with comparatively few long rods. Of this last-named morphological group it is noted that the greater part of them were found to form spores, and that most of them also were Gram-positive. Of the total number of strains isolated, more than half did not form spores and most were Gram-positive.

Ammonifying organisms were found in all of the soils examined, but were few except in the arable soils. More or less nitrification was found in all of the soils, though fixation of nitrogen was observed only in one soil. Denitrification appeared only in the arable soils, these last-named soils showing also the only cellulose fermentation.

The opinion is expressed that "the most striking fact is that so many organisms which are able to grow on the nitrogen-free medium were found in the virgin soils," and note is made of the fact that "in such soils as these the evolution of earth surface can be observed very closely in respect to physico-chemical and biological development."

Influence of adsorbed ions on soil reaction, B. AARNIO ([Finland] *Valtion Maatutkimuslaitos, Agrogeol. Julkaisu. (Bul. Agrogeol. Inst. Finland)*, No. 22

(1927), pp. 13, figs. 4).—The following statement is a partial indication of the nature of the experimental results and conclusions:

"When very diluted acid is added to the soil proofs . . ., we notice that the reaction becomes slightly more basic than it does in water solution. We may assume that this is due to an exchange of anions. As is well known, anions are absorbed in the surface of soil particles and form the envelopes next to them. We may suppose that there are also hydroxyl ions among those negative ions. When hydrochloric acid is added to the soil suspension, the hydroxyl ions, freeing themselves, exchange with the anions of the hydrogen chloric acid and influence the reaction. This would confirm the view that . . . ion exchange occurs also among anions, although to a lesser degree."

On the physiological reaction of salts [trans. title], M. GÓRSKI (*Rocz. Nauk. Rolnicz. i Leśnych (Polish Agr. and Forest. Ann.)*, 22 (1929), pp. 27-32, fig. 1; *Ger. abs.*, p. 32).—It is the author's opinion that the taking up of ions is dependent upon the reaction of the medium, the rapidity of absorption of cations decreasing with decreasing pH value, while the absorption of anions, on the contrary, increased with decreasing pH value. This being diagrammatically illustrated by a figure in which a line descending from left to right and an intersecting line rising from left to right represent the decreasing and increasing absorption rates for cations and for anions, respectively, in a plot drawn to represent the pH as decreasing from left to right, it is pointed out that one and the same salt may be physiologically acidic (left of the intersection point), physiologically alkaline (to the right of the intersection point of the diagram), or physiologically neutral when the reaction of the medium corresponds exactly with the intersection point of the two lines.

On electrolytes influencing the reaction in salt soils, A. SALMINEN ([*Finland*] *Valtion Maatutkimuslaitos, Agrogeol. Julkaisu. (Bul. Agrogeol. Inst. Finland)*, No. 27 (1928), pp. 8, figs. 2).—Investigation was made of the so-called alum soil of Finland and of an alkali soil, the conclusions reached including those indicated in the statement that "the acid reaction in the alum soils is due to aluminum sulfate, whilst in the alkali soils it is due to sodium carbonate. In order to remove this noxious acidity, recourse may be taken to drainage, liming, and theoretically to the employment of potassium salts, which are more effective in changing the reaction and which wash aluminum sulfate away more thoroughly." A table showing the chemical composition indicated by an analysis of the alum soil gives the figures 10.77 and 56.78 for the percentages of aluminum as oxide and of sulfate as sulfuric anhydride, on the basis of the total soluble salts, and 0.260 and 1.22 on the basis of the air-dried soil.

Studies on the physiological reaction of ammonium salts and nitrates [trans. title], A. MAKSIMOW (*Rocz. Nauk. Rolnicz. i Leśnych (Polish Agr. and Forest. Ann.)*, 22 (1929), pp. 33-38, figs. 41; *Ger. abs.*, pp. 86-88).—The following are included among the conclusions and observations recorded:

Plants altered the reaction of a solution of single salts only up to a certain value, not further changed, but varying with the different plants. In the case of physiologically acid salts the end values were for grain crops about pH 3.3, for leguminous species about pH 4.1. The course of the alteration of the H-ion concentration was not regular, appearing, in graphic form, as a distinctly uneven curve. Between the limits of concentration 0.001 and 0.02 π the strength of the solution of the salt appeared without effect upon the final reaction attained. The change in the reaction was accompanied always by the taking up of a nonequivalent quantity of the ions of the salt, this observation holding good equally in the cases both of physiologically acid and of physiologically alkaline salts. After the solutions reached the constant pH,

anions and cations were taken up equally except for certain disturbances considered probably to be explainable on the basis of the interference of exosmosis. The physiological reaction of ammonium nitrate was found not to be definite, and it is stated that no explanation of this behavior of the salt could be made.

The further conclusion was reached that physiological reaction of the salt is conditioned by the reaction of the medium, and that one and the same salt may show itself at different H-ion concentrations physiologically acid, neutral, or alkaline. After the establishment of the constant final reaction, however, the salts were physiologically neutral under the conditions of the experiments reported.

Alteration of muscovite and biotite in the soil, I. A. DENISON. W. H. FRY. and P. L. GILE (U. S. Dept. Agr., Tech. Bul. 123 (1929), pp. 32).—A study was made of the changes undergone during the development of a soil by the two forms of mica named with the use of the following method, worked out to meet the needs of the investigation here noted, for the separation of the two micas from the other constituents of the soil:

"A 300- to 600-gm. sample of soil was dispersed in 3 liters of water by rubbing the soil lightly between the fingers. The suspension, after a moment's settling in a beaker, was decanted upon a 200-mesh sieve. On the sieve were retained mica, particles of organic matter, small colloidal aggregates, and small mineral particles, while the dispersed colloidal material, together with the finest mineral particles, passed through the sieve and were discarded. The mass of soil in the beaker was dispersed as before and the suspension decanted, the process being repeated until the mica was practically removed from the residue of other minerals."

The data obtained include partial or complete analyses of mica samples isolated from one or more horizons of each of 21 soil profiles, together with petrographic estimations of the proportions of muscovite and biotite in the isolated mica mixtures, petrographic estimations of the total quantities of mica in the material of 39 horizons of 11 profiles, and determinations of the potassium and water contents of soil mica particles differing in size and in optical properties. It is noted, however, that "inasmuch as the micaceous soils examined were all from the region of the Piedmont Plateau, the results may not hold for all regions."

In numerous observations recorded, the average soil muscovite differed from the fresh mineral in the possession of a much lower potassium content and a much higher water content. The average soil biotite showed higher percentages of alumina, silica, and water, and lower percentages of magnesia, potash, and iron than did the fresh mineral, with the further difference that the soil biotite showed almost complete oxidation of the iron.

"Apparently neither in the case of muscovite nor of biotite is the alteration a simple replacement of basic elements by hydrogen. Evidence is presented to show that muscovite and biotite tend to be altered to a material of the composition of kaolinite, and it is suggested that altered particles of soil mica are isomorphous mixtures of muscovite and biotite with kaolinite. The chemical composition of a particle would thus depend on the proportions of the two constituents present. The mica of any one profile varies little in composition in horizons above the lowest C horizon. Mica in the hard rock, however, may have a quite different composition from that in the upper C or A horizons.

"The fact that the total quantities of mica in the different horizons of a profile remain fairly constant in composition, while large losses of mica may be taking place through alteration to clay material, is explained in terms of the alteration hypothesis proposed. According to this hypothesis, a certain propor-

tion of muscovite or biotite molecules may be changed to kaolin te molecules in the lowest part of the C horizon; this same proportion of the two constituents in the total quantities of mica is then maintained in the upper horizons, owing to a balance between the two changes, mica to kaolinite and kaolinite to clay."

On the influence of Surophosphat, Nitrophos, and phosphorite in comparison with superphosphate and Thomas slag [trans. title], M. GÓBSKI and J. KROTOWICZÓWNA (*Rocz. Nauk Rolnicz. i Lesnych (Polish Agr. and Forest. Ann.)*, 22 (1929), pp. 139-152, figs. 2; Ger. abs., p. 152).—Comparisons were made of various phosphate fertilizer materials used with various nitrogen treatments.

With superphosphate and Thomas slag there were applied for comparison Nitrophos (defined as a mixture of ammonium nitrate and phosphorite prepared by heat treatment), Surophosphat, and Polish phosphorites. The phosphoric acid of neither the Surophosphat nor the Nitrophos showed itself more effective than that of the Polish phosphorites. Amonium nitrate (and even more, ammonium sulfate) on account of their physiologically acidic character had a very marked effect upon the influence and utilization of the phosphorites.

Conservation of wastes from the small-scale slaughter of meat animals, G. P. WALTON and R. F. GARDINER (*U. S. Dept. Agr. Circ. 63 (1929)*, pp. 20, figs. 8).—For conversion into fertilizer material the wastes in question, either raw or rendered by means either of steam or of open kettle treatment, were mixed with quicklime, with superphosphate, or with sulfur and absorbents.

"Tests of converting raw offal into products that are suitable for use as fertilizer and that can be stored by mixing the offal with commercial grades of concentrated superphosphate and with ordinary superphosphate (acid phosphate) yielded satisfactory results when enough of the acidic agent was employed. Including in the mixtures a sufficient quantity of inert absorbent material to take up free water was found to be advisable."

No form of sulfur treatment was found satisfactory.

Inspection of fertilizers, W. L. ADAMS and J. E. BLANEY (*Rhode Island Sta. Ann. Fert. Circ.*, 1929, pp. 12).—Guarantees and analyses of 167 samples of fertilizers and fertilizer materials are reported. The authors noted an increasing tendency toward the preponderance of water-soluble inorganic nitrogen over the less quickly available forms of nitrogen.

AGRICULTURAL BOTANY

Influence of different nutrients on yield and composition in cultivated plants [trans. title], W. BEREZA (*Pam. Państw. Inst. Nauk. Gosp. Wiejsk. Puławach (Mém. Inst. Natl. Polon. Econ. Rurale Puław)*, 8 (1927), A, pp. 1-78; Fr. abs., pp. 75-78).—This account gives results of trials during 1920 to 1925, inclusive, regarding the influence of different nutrients on yield and composition in the case of rye, wheat, barley, oats, and potato, in "podsol," quite poor in all nutrients, with subsoil rich in iron. The tabulations and discussions as detailed show very unequal influences as regards quality and duration of effects of chemical factors, as nitrogen, potassium oxide, magnesium oxide, and phosphorus pentoxide.

The migration of mineral nutritive substances during growth of plants [trans. title], L. ZALESKI (*Pam. Państw. Inst. Nauk. Gosp. Wiejsk. Puławach (Mém. Inst. Natl. Polon. Econ. Rurale Puław)*, 8 (1927), A, pp. 239-294, figs. 6; Fr. abs., pp. 292-294).—Details are given regarding the movement of nutrients or necessary substances in plants as made evident in experiments devised for that purpose.

Tissues involved in the transfer of mineral salts in plants, E. T. BODENBERG (*Wash. Univ. [Seattle], Puget Sound Biol. Sta. Pubs.*, 5 (1927), pp. 231-244).—Work is reported as carried on at the Ohio State University during the winter of 1925 and the spring of 1926 with dilute, nontoxic solutions of the nitrates of lithium and of caesium, which do not usually occur in the plants used (*Salix amygdaloides*, *S. nigra*, *S. fragilis*, *Liquidambar styraciflua*, and *Acer negundo*) and are easily detected spectroscopically. Xylem and phloem tissues were cut in the respective plants, and injury or drying of the remaining tissues was minimized.

It was found that the removal of a section of phloem by ringing retards the movement of lithium and caesium into the plant parts above the ring. It is thought that this may be due entirely to lessened transpiration, which was noted in the case of ringed plants.

The removal of a section of xylem 0.5 cm. long completely obstructed the upward movement of both salts. A case of apparent exception was supposed to be due to the development of new xylem. The reduction of transpiration results in a much reduced rate of upward movement of salts. The practical elimination of the transpiration factor decreases the movement to the point where diffusion alone might be considered to account for the transfer. Apparently downward transfer may occur by way of the xylem. It is thought that the upward and the downward movement of mineral salts occurs principally through the xylem tissues, and that the chief agent by which this movement takes place is the transpiration stream, though the movement may be aided by diffusion, by protoplasmic streaming, or by transfer along threads of protoplasm.

Microchemical research of phosphorus in tissues of plants and animals [trans. title], G. POLLACCI (*Riv. Biol.*, 9 (1927), No. 1, pp. 11-16).—This is the author's contribution to a controversial discussion.

Some effects of calcium compounds on the soil and on plant growth, W. T. H. WILLIAMSON (*Scot. Jour. Agr.*, 10 (1927), No. 2, pp. 180-184).—Having previously (*E. S. R.*, 55, p. 618) emphasized the importance of a supply of calcium in the soil and pointed out the chief effects of lime in soil improvement, the author now discusses some effects of other compounds of calcium on soil and on plant growth, as noted in experimentation which is considered as not yet sufficiently mature to justify the drawing of general conclusions.

Checking and acceleration of growth in plant neoplasms experimentally irradiated [trans. title], V. RIVERA (*Riv. Biol.*, 9 (1927), No. 1, pp. 62-70, figs. 2).—Regarding the author's work on the effects upon neoplasms or upon normally growing parts of plants resulting from irradiation, some accounts have been noted (*E. S. R.*, 56, p. 629; 57, p. 840; 58, p. 217). The present account gives in statistical detail and in graphical form an account of behavior in neoplasms experimentally induced in *Pelargonium* and afterwards subjected to X-rays. After irradiation a short period of indecisive and slight increase occurred, but this was succeeded by a steep and decided lessening in the size of the neoplasm.

Relations between soil water content and soil water vapor pressure, also between soil absorptiveness and wilting in plants [trans. title], F. BACHMANN (*Ztschr. Wiss. Biol., Abt. E, Planta, Arch. Wiss. Bot.*, 4 (1927), No. 1-2, pp. 140-180, figs. 13).—The water content of soil was not so successfully calculated on the dry weight of the soil as upon its water capacity. The leaf water content in *Phaseolus*, in contrast with that in *Lupinus*, *Vicia*, and *Oenothera*, showed clear relationship to the absorptiveness of the soil. The utilisability of soil water during high transpiration is partly dependent upon

the mobility of the water in the soil and upon the magnitude and arrangement of the water-absorbing surface of the plant, regarding which further studies were planned.

Vascularization of the node in *Zea mays*. A. T. EVANS (*Bot. Gaz.*, 85 (1928), No. 1, pp. 97-103, figs. 7).—The problem of following up the course and branching of vascular bundles in *Z. mays* has been solved by a simple procedure, which is descriptively shown, so that staining with methylene blue, for study, is comparatively easy. Retting permits washing out of parenchymatous cells. Single vascular bundles seldom pass more than two or three nodes without branching. The nodal complex of small branches arises from vascular bundles at the point of their entry into the node and from smaller peripheral bundles. The nodal complex results from division and subdivision of these small bundles, which later anastomose with those from other bundles.

Annual wood of grapevines and its maturation [trans. title], M. STAEBELIN (*Ann. Agr. Suisse*, 28 (1927), No. 4, pp. 397-411, figs. 12).—The maturation of wood is a physiological phenomenon of alimentation, heat, light, humidity (in moderation), and good situation influencing the vital process and advancing the maturation of the wood. Phases are particularized.

Abscission in cotton flowers. C. P. DUTT (*Bot. Gaz.*, 85 (1928), No. 2, pp. 208-220, figs. 7).—Abscission of the cotton bloom occurs usually at or near the base of the internode, sometimes in the middle, the position of the abscission zone usually being indicated by a groove or surface depression, except in the case of very young material. The abscission zone consists of from 10 to 12 rows of cells. The separation layer, located near the upper (distal) region of the abscission zone, consists of 1 to 2 cell layers, and is formed by the chemical dissolution of the cell walls. No evidence of cell division appears in the abscission zone of the cotton bloom. All the tissues across the pedicel except the tracheal tubes function in abscission. The first visible indication of abscission is the swelling of the cell walls, and this is followed by their partial solution. Prior to abscission starch in large quantity is stored in the abscission zone, disappearing later during the development of the zone.

GENETICS

Studies on pigeon hybrids, I, II. L. J. COLE, T. S. PAINTER, and A. ZEIMET (*Anat. Rec.*, 41 (1928), No. 1, pp. 103, 112).—The results of studies of the effect of crossing the domestic pigeon (*Columba livia*) ♂ with the Barbary dove (*Streptopelia risoria*) ♀ and the Chinese Pearlneck dove (*Spilopelia chinensis*) ♂ with the Barbary dove ♀ are reported from the Wisconsin Experiment Station and the University of Texas.

I. Aberrant sex ratios (p. 112).—Of 575 fertile eggs laid by Barbary dove ♀s crossed with domestic pigeon ♂s only 225 hatched, there being a very large death rate of embryos within the first few days of development. Of the 225, all were males except 3. Similar results were obtained in the cross of Chinese Pearlneck dove ♂s with Barbary dove ♀s, but the excess of males was not so high. Heavy mortality of females is considered as the explanation, there being no evidence of sex reversal from the behavior of sex-linked characters.

II. The chromosome conditions as an index of differential mortality of embryos (p. 103).—Cytological studies were made of the chromosome constitution of individuals from the above crosses, using both germinal and somatic tissue. The pigeons and doves were found to be very similar in their chromosome make-up, there being some 60 chromosomes including 6 large ones in the male and 5 in the female. Males have 2 pairs of V-shaped chromosomes, 1 pair being larger than the other, the former being the sex chromosomes, and females

have but one of the large V's. All of the testes of adult hybrids which were studied had the chromosome constitution of males. Cytological studies of the embryos undergoing the well-marked changes prior to death indicated that they had the female sex-chromosome constitution, supporting the hypothesis that the adult hybrids are genetically males, and that females are produced in the cross but die in the early embryonic stages.

Is there a spermatozoa dimorphism in domestic cattle? [trans. title], H. KRALLINGER (*Arb. Deut. Gesell. Zuchtungsk.*, No. 40 (1928), pp. [4]+48, figs. 25).—From a cytological study the author finds that the haploid chromosome number in cattle is 30 and the diploid number 60. Neither in spermatogenesis nor in maturation was a chromosome of unusual size found, though one of average size having a peculiar behavior in the first maturation division was observed. There was no evidence of a spermatozoa dimorphism. It is concluded from the study that sex determination is not alone based on a chromosome mechanism, but is related to three factors, the cell chromatin, the plasma, and the hormones developing in embryonic stages.

The comparative effects of the same genes in different quantities, R. K. NABOURS (*Anat. Rec.*, 41 (1928), No. 1, pp. 100, 101).—Examples of the effects of the same gene in different quantities are described from experiments conducted at the Kansas Experiment Station with *Apotettix eurycephalus*. In case of the factors *Y* for a dominant large white spot on and *T* for dominant mahogany red over the pronotum, which have a linkage relationship of about 7 per cent, it is reported that individuals of the composition $\frac{Y}{+} \frac{+}{T}$ showed the white spot modified by the mahogany, $\frac{Y}{Y} \frac{T}{+}$ exhibited the white spot conspicuously with a mere tinge of the mahogany, and $\frac{Y}{+} \frac{T}{T}$ showed the white spot greatly obscured by the mahogany.

Occurrence of "lintless" cotton plants and the inheritance of the character "lintless," F. GRIFFEE and L. L. LIGON (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 7, pp. 711-717).—Lintless cotton plants, i. e., with smooth seeds and practically no lint, were crossed at the Oklahoma Experiment Station with King, a cotton with linted, fuzzy seed and red-centered flowers. The lintless character seemed to depend for its expression on a single factor partly dominant to the normal, the heterozygous condition being linted smooth. This factor pair seemed to be inherited independently of the pair for petal spot v. no petal spot. The lintless character is suggested as the result of mutation. Natural crossing was estimated to have taken place to the extent of 19.35 per cent on a single row from neighboring rows and likewise between plants in the row.

Bulked-population method of handling cereal hybrids, V. H. FLORELL (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 7, pp. 718-724).—The course of a bulked population experiment with wheat hybrids made by the U. S. Department of Agriculture, cooperating with the California Experiment Station, is reviewed, and the characteristics and possibilities of the method are described.

Chromosome translocations produced by X-rays in *Drosophila*, H. J. MULLER and E. ALTENBURG (*Anat. Rec.*, 41 (1928), No. 1, p. 100).—Studies of the frequency of translocations between nonhomologous chromosomes produced by X-rays indicated that they occurred nearly as frequently as detectable gene mutations. They apparently involved attachments between any two or more of the chromosomes and at different levels. Cytological study indicates that the map regions of the chromosomes which are more crowded with genes represent relatively greater chromosome lengths. A few individuals inheriting the loss

of a small piece or the presence of an additional piece of a chromosome are frequently viable and reflect the genic unbalance. In this way it was possible to prove that the left half of the X chromosome was not sex determining, from which it is assumed that sex differentiation is accomplished by a single gene locus. Practical application is being made of strains in which translocation has occurred.

Artificial insemination of female guinea-pigs as a method of investigating problems in the physiology of mammalian spermatozoa, W. C. YOUNG (*Anat. Rec.*, 41 (1928), No. 1, p. 37).—A practical technic for the artificial insemination of female guinea pigs with sperm removed from the epididymis of the male has been developed for studies of the action of high temperature on the reproductive capacity of the guinea pig sperm and the changes resulting from the passage through the epididymis. The method employed consisted of macerating the epididymis of normal males in approximately 10 cc. of Locke's solution and the injection of from 0.5 to 1 cc. of the suspension. This resulted in from 65 to 75 per cent of fertility.

A preliminary study of the function of the epididymis, W. C. YOUNG (*Anat. Rec.*, 41 (1928), No. 1, pp. 71, 72).—In a study of the function of the epididymis, experiments so far completed indicate that the epididymal secretions play no part in aiding the sperm to obtain full maturity. It appears that the function of the epididymis is to act as a reservoir for sperm in which the important processes of sperm development starting in the testis are continued.

Variations in mouse embryos of eight days' gestation, E. ALLEN and E. C. MACDOWELL (*Anat. Rec.*, 41 (1928), No. 1, p. 77).—Attention is called to the fact that in the same litter of mice, embryos may be at nearly the same stage of development at eight days of gestation or may vary from the presomite stage to seven somites. Litter variation and variation within the litter are independent of litter size, of number in one cornu, and of the position in the cornu of the uterus.

The hydrogen ion concentration of the reproductive organs of the White Leghorn chicken, G. D. BUCKNER and J. H. MARTIN (*Amer. Jour. Physiol.*, 89 (1929), No. 1, pp. 164-169).—In studies at the Kentucky Experiment Station, the hydrogen-ion concentration of the secretions from various portions of the oviduct of laying hens, a hen that had nearly stopped laying, a hen that had not laid for 20 days, and a hen that had never laid was determined, as well as the hydrogen-ion concentration of eggs in different stages of formation and held for 20 days after laying.

The results showed that the pH of the egg albumin from a fresh-laid egg was 8.2 and that from an egg 20 days old 9.8, the increased alkalinity being due to the loss of CO₂ and autodigestion of the proteins. The pH of the egg albumin from a shell-less and from a shell-less and membraneless egg was 7.4. The pH of the different portions of the oviduct was approximately 6.5 from the funnel to the lower albumin-secreting section, but it dropped to 5.8 from the isthmus to the vagina. In the hen that had never laid and the one which had nearly stopped laying, the pH from the isthmus to the vagina ranged from approximately 6.2 to 6.6, suggesting that the difference in acidity may be associated with the formation of the shell membrane and the eggshell.

Effect of corpus luteum and ovarian extracts on the oestrus of the guinea pig, D. I. MACHT, A. E. STICKELS, and D. L. SECKINGER (*Amer. Jour. Physiol.*, 88 (1929), No. 1, pp. 65-76, fig. 1).—Injections of water-soluble extracts of powdered corpora lutea were found to reduce the number of maturing follicles and increase the duration of the average interoestrous period in the guinea pig. In one experiment the normal interoestrous period averaged 13

days but after treatment 37.4 days, and in another experiment the normal averaged 10.9 days and after treatment 28 days. In other tests injections of follicular extract shortened the dioestrous period and brought on the normal oestrous picture in the vaginal smears. Extracts of whole ovaries prolonged the dioestrous period as a rule, while injections of extracts of ovarian residue appeared to have no influence on the duration of the cycle. Other glandular tissue extracts except those of the placenta had no inhibiting influence on oestrus.

The relation of parity, age, and body weight to the number of corpora lutea in mice. E. C. MACDOWELL, E. ALLEN, and C. G. MACDOWELL (*Anat. Rec.*, 41 (1929), No. 3, pp. 267-272, figs. 5).—Counts of the corpora lutea of 1,183 mouse pregnancies indicated that the average number of corpora lutea increased with parity, but remained constant within the same parity as age increased. In the ovaries of 339 females at the first pregnancy, it was found that the number of corpora lutea increased with the weight of the female up to about 24 gm., after which the corpora lutea count was not associated with weight. In the first pregnancy the number of corpora lutea classified by age showed only a slight tendency toward a correlation and remained practically constant within the same weight class as the age increased. It is suggested that as the anterior pituitary body exercises a rather definite control over weight and as the number of corpora lutea increase with weight, the number of corpora lutea is correlated with the size of the anterior pituitary gland.

Physiology of the corpus luteum, II, III (*Amer. Jour. Physiol.*, 88 (1929), No. 2, pp. 326-346, figs. 19).—In continuation of this series (E. S. R., 60, p. 32) two studies are noted.

II. Production of a special uterine reaction (progestational proliferation) by extracts of the corpus luteum, G. W. Corner and W. M. Allen (pp. 326-339).—It was found that injection of alcoholic solutions of corpus luteum, freed from phospholipids, into female rabbits which were castrated and had a portion of the uterus removed for histological control, induced proliferation of the endometrium which was identical with the progestational proliferation due to the presence of corpora lutea. The does were mated 18 hours prior to castration to induce ovulation and were killed 5 days later for study of the endometrium. Similar effects were sometimes produced in immature rabbits from 8 to 12 weeks old by the corpus luteum injection, but this was not constant. Neither follicular extracts nor human placental extracts caused the progestational proliferation.

III. Normal growth and implantation of embryos after very early ablation of the ovaries, under the influence of extracts of the corpus luteum, W. M. Allen and G. W. Corner (pp. 340-346).—Though it was shown in the first paper of this series that the removal of the ovaries or the ablation of the corpora lutea during the latter part of the first day after mating resulted in the degeneration of the embryos on the fourth day of pregnancy, it was found possible in this study to maintain sufficiently normal condition in the uterus of does having their ovaries removed within 18 hours of breeding, by injections of corpus luteum extract, to allow some of the fetuses in two does to develop normally up to the thirteenth and eighteenth days of gestation, when the dams were killed. This appears to complete the evidence that in the rabbit one of the functions of the internal secretions of the corpus luteum is to produce progestational proliferation of the uterine mucosa, which nourishes or protects the free blastocysts and makes possible their implantation.

The effect of different amounts of sexual indulgence in the albino rat.—V, The offspring, J. R. SLONAKER (*Amer. Jour. Physiol.*, 84 (1928), No. 2, pp. 442-452).—In continuing this series (E. S. R., 59, p. 30) further data are given on the effects of light, medium, and heavy breeding. The following table gives a summary of the average results for each group:

The length of gestation, number of litters, litter size, weight, and mortality in young produced by light, medium, and heavy breeding parents

Breeding	Average number of litters	Average gestation period	Average size of litter	Average young per dam	Average birth weight		Young died	Males per 100 females
					Males	Females		
Light.....	2.87	21 days 20.8 hours.....	4.70	12.6	Grams 5.44	5.10	Per cent 36.00	92.0
Medium.....	6.66	22 days 2.2 hours.....	5.83	50.6	5.20	4.72	33.00	92.0
Heavy.....	10.00	22 days 6 hours.....	6.83	60.7	5.05	4.69	1.47	98.6

The young in the heavy breeding group were destroyed at birth to stimulate more rapid breeding.

The effect of injection of follicular extract on the sex organs in the guinea pig and the interaction between the follicular substances and substances given off by the corpus luteum, L. LOEB and W. B. KOUNTZ (*Amer. Jour. Physiol.*, 84 (1928), No. 2, pp. 283-306).—In continuation of studies at the Washington University School of Medicine, previously noted (E. S. R., 57, p. 723), the effects of injections of the follicular and corpus luteum hormones into immature female guinea pigs and into females which had been undernourished or castrated, as well as at different stages of the oestrous cycle or during pregnancy, have been tested.

Injections of the follicular hormone accelerated the maturation of follicles in immature animals and in underfed females, but prevented ovulation as long as the injections were continued. The follicular extract caused a proliferation of the vaginal epithelium corresponding in a lesser degree to the changes occurring in the follicular phase of the oestrous cycle. The persistent corpora lutea of pregnancy and following hysterectomy tend to counteract the effect of the follicular hormone on proliferation of the vaginal mucosa. Follicular extracts had a little effect on the uterine mucosa, but did not produce the sensitization to mechanical stimuli resulting in the developing of placentomata, as has been demonstrated as an effect of the corpus luteum hormone. The corpus luteum hormone, however, causes no proliferation of the vaginal mucosa. The follicular hormone also induces proliferation of the mammary gland.

FIELD CROPS

[Field crops experiments at the Alaska Stations, 1928], H. W. ALBERTS (*Alaska Stas. Rpt. 1928*, pp. 8, 9, 10-14, 20-24, figs. 3).—Report is made as heretofore (E. S. R., 60, p. 728) of the progress of variety trials with potatoes, oats, barley, and wheat; production tests with different cereals, legumes, grasses (notably timothy), and root crops; tests of crop combinations for hay; and crop rotations.

[Agronomic work in Mississippi, 1928], J. F. O'KELLY, C. F. BRISCOE, W. E. AYRES, C. T. AMES, E. B. FERRIS, H. F. WALLACE, and S. W. GREENE (*Mississippi Sta. Rpt. 1928*, pp. 10-13, 19, 20, 45, 46, 47, 48, 52, 56-59, 64).—Experiments with field crops at the station and substations were continued in

1928 along similar lines as in 1927 (E. S. R., 62, p. 81) and comprised breeding work and varietal trials with cotton, corn, and soybeans; comparisons of winter legumes and silage crops; cultural (including planting) tests with soybeans and sweetpotatoes; fertilizer trials with cotton, corn, sugrains, alfalfa, and lespedeza; and inoculation studies with soybeans. Recent work of the Holly Springs, Raymond, and South Mississippi Substations have been detailed from other sources (E. S. R., 61, pp. 432, 433.)

In pedigree selection studies within certain cotton varieties significant correlations were observed between the lint percentage of the selection and the percentage of the progeny, and likewise for lint length, whereas the correlation for yield, while positive, was not significant. When the factor for naked seed coat was carried by a short staple upland variety, naked seed was dominant, giving a 3:1 segregation in the F_2 . Later crosses indicated that the factor for naked seed, if brought in by a Sea Island parent, is recessive, and the seed coats in F_1 are fuzzy.

Comparison of formulas for cotton on important soil types led to the recommendation for Mississippi outside of the Delta of from 600 to 900 lbs. per acre of an 8-6-4 (P-N-K) fertilizer, and in some cases, an 8-4-4 for acid soils and 8-8-0 for alkaline or nearly alkaline soils, with the addition of potassium where rust prevails. In a study of organic: inorganic nitrogen carriers, a yield decrease accompanied an increase in the proportion of organic nitrogen.

During seven years at the Delta Substation sodium nitrate, ammonium nitrate, ammonium sulfate, and cyanamide ranked in order as nitrogen carriers for cotton, with from 25 to 30 lbs. of nitrogen as the most economical acre application. The same rank and rate also held for corn. Phosphorus did not pay on cotton. Nitrogen did best when applied before planting cotton, and for corn when plants were from 1 to 2 ft. high.

Lespedeza receiving 200 lbs. of superphosphate per acre at the Coastal Plain Substation returned in excess of 1 ton of cured hay per acre more than the untreated plot, but other fertilizers were unprofitable.

Irrigated crop rotations in southern Montana, S. H. HASTINGS and D. HANSEN (*U. S. Dept. Agr., Tech. Bul. 177* (1929), pp. 32, figs. 2).—Experiments to determine the rotations and cropping methods best suited to the irrigated area representative of south-central Montana and similar areas of the Great Plains were carried on since 1912 at the Huntley, Mont., Substation (E. S. R., 61, p. 724) in cooperation with the Montana Experiment Station and the U. S. Department of the Interior, Bureau of Reclamation. The technic and the environmental conditions and crop yields are set forth in detail.

Determination of the annual fluctuations in yields showed 1918 to have the highest annual mean percentage, 120, and 1926 the lowest with 81. For the last 6 years, crop yields in the rotations including alfalfa or receiving manure, or both, showed a percentage increase over those in untreated rotations, for oats 39, sugar beets 43, and potatoes 48.

Oats made their highest yield in rotations including alfalfa, the mean of two 2-year rotations receiving stable manure came second, and the lowest yields were from plots cropped continuously.

Manure applied in 2-year and 3-year rotations was more effective for increasing sugar beet yields than was alfalfa. All treated rotations showed a marked tendency to increase yields as the rotations were continued. Comparatively low yields came from plots cropped continuously, and the mean yields from the two 2-year rotations wherein beets followed wheat and oats were no better.

The highest potato yields were from the mean of the two 6-year rotations which included alfalfa in 3 of the 6 years. While the beneficial effects of ma-

manure on potato yields were apparent, the yields appeared to be maintained better where manure was applied directly before potatoes every third year in a 3-year rotation instead of in alternate years in a 2-year rotation. Planting potatoes after oats, with rye for green manure seeded after the oats, was not satisfactory. Continuous cropping of potatoes appeared to lower the soil productivity and to complicate the disease problem.

Alfalfa fields may be kept up over long periods if the stand can be maintained. While the first-year alfalfa gave low yields, the second-year yields fully equaled the average of the third season. When grown in a 2-year rotation with oats, wheat yielded no better than when cropped continuously, and continuous wheat with straw returned made the lowest yield for the last 6 years. Wild oats affected adversely the yields of continuous wheat and of wheat in the 2-year rotation with oats. Yields of corn from untreated 2-year and 3-year rotations were slightly more than maintained, while the yields from continuous corn tended to fall as the rotations were continued.

Comparison of the relative acre values of the different rotations emphasized the importance of adopting a well-designed cropping system, and showed that crop yields are increased materially by the application of manure or the inclusion of alfalfa in a rotation. After estimated expenses and reasonable values placed on the first crops were deducted, the net returns seemed to justify the practices.

[Crops experiments at the Hettinger, N. Dak., Substation, 1928], C. H. PLATH (*North Dakota Sta. Bul.* 229 (1929), pp. 6-19).—Agronomic experiments, resumed in 1927, and reported on as heretofore (*E. S. R.*, 51, p. 533; 53, p. 333) for 1928, included variety tests with spring wheat, oats, barley, emmer, flax, corn, alfalfa, field peas, potatoes, and miscellaneous forage crops; cultivation (including planting) tests with corn, alfalfa, and sweetclover; row-row trials with wheat; a combining test with barley; potato seed treatments; and crop rotations.

[Field crops work at the Langdon, N. Dak., Substation, 1927 and 1928], V. STURLESON (*North Dakota Sta. Bul.* 228 (1929), pp. 4-7, 8-12, 16-22, 24-30, 31, 32, figs. 8).—Experimental work, resumed in 1927 and reported on for 1927 and 1928 as in earlier years (*E. S. R.*, 51, p. 533), comprised varietal trials with spring wheat, oat-, barley, flax, field peas, corn, sweetclover, alfalfa, millet, grasses, potatoes, sugar beets, mangels, rutabagas, carrots, and potatoes; a planting test with corn; a demonstration of cleaning up weedy lands by crop rotation and sheep; and crop rotations.

[Agronomic experiments at the Porto Rico Insular Station], M. T. COOK, P. RICHARDSON KUNTZ and R. FERNÁNDEZ GARCÍA (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt.* 1928, Eng. ed., pp. 16-19, 20, 21, 25-43, 68-88, figs. 7).—Investigations with field crops are reported on for the fiscal year ended June 30, 1928.

Extensive comparison by Richardson Kuntz and L. A. Serrano with cane varieties for localities and special conditions, made at the station and elsewhere in the island but not quite completed, showed Co. 213 and P. O. J. 228 to do better than Uba or Japanese cane, according to field and mill observations. At the Sabana Grande model farm Co. 213, Co. 281, P. O. J. 2714, D. 1135, and Uba canes were most promising. Agronomic characteristics are indicated for many of the canes under test, and the results of liming and green manure tests, trials of cropping systems, and comparisons of grasses are noted briefly.

In fertilizer experiments with sugarcane reported on by Fernández García, treatments with a maximum of 150 lbs. of ammonia, phosphoric acid, or potash

did not have a noticeable effect on the period of maturity or quality of the juice. Climatic conditions appeared to affect quality of juice more than did the fertilizer application. Trials of complete fertilizers according to the triangular method showed that the heavier nitrogen applications gave the higher yields, plats receiving more than 120 lbs. of ammonia per cuerda (1.01 acre) giving the highest gain in yields, and plats receiving no nitrogen making practically no more than the checks. Phosphoric acid and potash in variable quantities seemed necessary for ratoons as well as for plant cane in the three soil types used. Phosphoric acid in excess of 60 lbs. per cuerda appeared to reduce the gain in yields. Although plats receiving the heavier applications of nitrogen returned the higher yields, the most profitable combination for both plant and ratoon crops in the three experiments seemed to be that supplying 80 lbs. of ammonia, 30 lbs. of phosphoric acid, and 120 lbs. of potash per cuerda.

Ammonium sulfate gave better results than sodium nitrate as a nitrogen carrier. However, the superiority of the ammonium sulfate was not so great or so constant with ratoons as on plant cane. No decided advantage over a single application of complete fertilizer came from dividing the application or applying different quantities of ammonium sulfate before or after the complete fertilizer, nor did profitable returns follow the heavier applications of nitrogen.

The addition of cane trash was found to lower the level of nitrate concentration in the soil, whereas application of ammonium sulfate raised the nitrate level even when trash was added at the rate of 15 tons of air-dried material per acre. Under acid conditions the nitrification of the sulfate of ammonia was slower to start but reached a higher level of nitrate concentration at six months' time than under nearly neutral conditions. The effect of applications of soluble manganese salts and manganese ores on the sucrose content of Uba cane seemed to be negligible, although germination was favored.

[Agronomic studies in England] (*Jour. Natl. Inst. Agr. Bot.*, 2 (1929), No. 2, pp. 87-176).—Continued investigations (E. S. R., 60, p. 133) on winter wheat varieties (1924-1928) are reported on by S. F. Armstrong; on winter oats varieties (1924-1928) by E. G. Thompson; and on fertilizer trials with wheat (1927-28), on winter (1927-28) and spring cereals (1928), and on cereal crops in Essex, all by F. C. Hawkes. Reports of the Lord Derby Gold Medal potato trials (1928) have been rendered by W. H. Parker and H. Bryan, and the Potato Synonym Committee (1928) by R. N. Salaman. Tests made to determine the bread-making quality of wheats harvested in 1925, 1926, and 1927 at the test stations of the institute are reviewed by A. E. Humphries, J. P. Clover, and R. Hutchinson.

Symposium on "pasture management research," A. B. BEAUMONT ET AL. (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 6, pp. 589-709, figs. 11).—This symposium, presented in New York City, in December, 1928, comprises a number of papers, most of which include lists of references on their respective subjects. The following papers are included: Comparative Returns in Feed Units from Crop Rotation and Pasture, by J. W. White (pp. 539-593); Income from Crop and Pasture Land, by E. G. Misner (pp. 594-603); Practices and Conditions Determining the Most Productive Permanent Pastures in New Jersey, by H. B. Sprague (pp. 604-607) (E. S. R., 60, p. 34); Ecological Factors Determining the Pasture Flora in the Northeastern United States, by H. P. Cooper, J. K. Wilson, and J. H. Barron (pp. 607-627); The Hohenheim System, by K. Peter (pp. 628-633); Pasture Investigations in the Southeastern States, by H. N. Vinall (pp. 633-644); Range Research of the U. S. Forest Service, by W. R. Chapline (pp. 644-649); Analysis of Seeding Mixtures and Resulting

Stands in Irrigated Pastures of Northern Colorado, by H. C. Hanson (pp. 650-659); The Eradication of Brush and Weeds from Pasture Lands, by A. E. Aldous (pp. 660-666) (E. S. R., 61, p. 125); Methods of Research in Pasture Investigations, by G. L. Schuster (pp. 666-673); The Effect of Fertilizer Treatments upon the Quantity and Quality of Pasture Vegetation.—I, Mineral Treatments, by B. A. Brown (pp. 673-678). II, Nitrogen Treatments, by H. Dorsey (pp. 679-686); The Chemical Composition of Grass from Plots Fertilized and Grazed Intensively, by J. G. Archibald and P. R. Nelson (pp. 686-699); and The Role of Pasture in the Mineral Nutrition of Farm Animals, by L. A. Maynard (pp. 700-709).

An intensive system of grassland management, C. H. PARSONS (*Amer. Soc. Anim. Prod. Proc.* 1928, pp. 61-67).—Experience in 1923 with a pasture at the Massachusetts Agricultural College carried on under the Hohenheim system showed that a thick sod is essential for best results from fertilizers. Heavy treatment with nitrogenous fertilizers increased markedly the quantity of grass and also increased its nitrogen and calculated protein content. It appeared that the carrying capacity of pastures may be increased by the use of the principles involved in this system.

The chemical composition of *Andropogon virginicus* and *Danthonia spicata* at successive growth stages, R. B. DUSTMAN and L. C. SHRIVER (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 5, pp. 561-567).—Two wild pasture grasses, broom sedge (*A. virginicus*) and poverty grass (*D. spicata*) were cut at successive growth stages at the West Virginia Experiment Station. Analyses showed that these, in common with other pasture grasses, are relatively high in protein and low in fiber early in growth as compared to later stages. The best utilization of their pasturage involves reasonably early, close, and continuous grazing during spring and early summer. Removal of the old growth of broom sedge before the new growth appears will permit better grazing of the new growth by livestock.

The North American species of *Paspalum*, A. CHASE (*U. S. Natl. Mus., Contrib. U. S. Natl. Herbarium*, 28 (1929), pt. 1, pp. VIII+310+XI-XVII, figs. 142).—The genus *Paspalum* comprises more species than any other genus of grasses in North America except *Panicum*, and for the whole of America these two genera are about equal. *Paspalum* is represented in continental United States by 43 species, although it reaches its greatest development in tropical America. Several species are important forage grasses, and one is a troublesome weed in drainage canals. Of the 140 species and 3 subspecies described, 18 species are indicated as new.

A method of removing borders from grain plots, F. M. MACISAAC (*Sci. Agr.*, 9 (1929), No. 10, pp. 689-692, figs. 4).—A method devised at the Scott, Sask., Experimental Station for removing plot borders is described as simple, cheap, and efficient.

Effect of size of seed piece and rate of planting on yields of white potatoes, H. B. SPRAGUE and E. E. EVAUL (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 5, pp. 513-523, fig. 1).—Planting tests were made at the New Jersey Experiment Stations with certified Green Mountain potatoes during 1924, 1925, and 1926. In rows 33 in. apart, 0.5-oz. sets were spaced from 6 to 12 in. apart, 1-oz. sets 9 to 18 in. apart, and 1.5-oz. sets 9 to 22.5 in. apart, each weight having two intermediate spacings.

Lessening the space between sets of the same size has increased yields, as did increasing the size of set when the distance in the row remained the same. With the same total weight of seed per acre the highest yields came from 0.5-oz. sets and the lowest from 1.5-oz. sets, with 1-oz. sets intermediate in this respect. The net yields (total yields less the quantity of seed used per acre) have in-

creased with the rate of planting for each size of set. The greatest returns of crop per bushel of seed were obtained from 0.5-oz. sets spaced 12 in. apart in the row. Size of set and planting rate had no appreciable effect on the percentage (by weight) of tubers weighing over 45 gm. each. Variations in yield were due primarily to changes in the number of tubers weighing over 45 gm. each and not to their average individual weight.

Influence of shape on the chemical composition of potato tubers, J. J. WILLAMAN and A. M. CHILD (*Plant Physiol.*, 4 (1929), No. 3, pp. 385-392).—Measurements of the shape of several lots of potatoes, including several varieties, at the Minnesota Experiment Station in 1922 and 1923 were supplemented by analyses for dry matter and nitrogen. See also an earlier note (E. S. R., 54, p. 639).

When the shape ratios of Early Ohio potato tubers were compared among themselves a marked positive correlation was noted between length-width and length-depth and between length-depth and width-depth, but no relation between length-width and width-depth. The length was also the dominating dimension when the shape ratios were compared with size of tuber, indicating that growth of the tubers in size is largely because of increased length. The nitrogen content of the tubers seemed to be governed more by the depth than by any other dimension. The smaller tubers tended to have a higher nitrogen content than the larger. These conclusions appeared to hold whether the comparisons were made within a variety or among samples of tubers from several varieties. The authors consider that high protein content, if sought in potatoes, will more likely be found in a variety having moderate-sized tubers spheroidal in shape.

The influence of temperature of irrigation water on the growth and yield of rice, S. KIKKAWA (*Imp. Acad. [Japan], Proc.*, 5 (1929), No. 7, pp. 303-305).—Water at 15, 20, 26, 32 and 37° C. was supplied to Sekitori rice in tanks. Yields and other agronomic data over a period of 4 years indicated that the optimum temperature for irrigation water for this rice under the climatic conditions of Tokyo is about 32° (89.6° F.). Departures above or below the optimum resulted in decided decreases in grain and total yield.

Methods of harvesting grain sorghums, J. H. MARTIN, L. A. REYNOLDS, B. E. ROTHGER, and W. M. HURST (*U. S. Dept. Agr., Tech. Bul.* 121 (1929), pp. 37, figs. 18).—The methods used in harvesting grain sorghums in southwestern Kansas and northwestern Oklahoma were studied in cooperation with the Kansas and Oklahoma Experiment Stations and the Kansas Engineering Experiment Station during the season of 1926. Milo and kafir were the principal grain sorghums grown. Two general types of farming, viz, wheat growing on the heavier soils and grain sorghum and broomcorn growing on the sandy soils, are practiced in the area investigated. Very few livestock except work horses are kept on the farms. Nearly half of the farmers owned tractors, and about one-fourth of them had trucks.

Much of the milo and some of the kafir was headed by hand. The machines used for harvesting grain sorghums included row binders (corn binders), grain headers, combines, special kafir headers, and grain binders. Nearly half of the farmers used two or more methods of harvesting in 1926. The largest average acreage was cut with grain headers and the smallest acreage with the row binder. Kafir seemed to be better adapted than milo to machine harvesting. More than half of the grain sorghum was harvested before frost.

The losses from heads left in the field averaged 10.9 and 6.4 per cent, respectively, for kafir cut with the combine and the grain header and 25.9 and 13.5 for milo (Dwarf and Standard). The losses in harvesting with the row binder were small, and those in harvesting by hand were inconsequential. Many of the farmers picked up the loose heads.

Most of the combines were drawn by tractors. The combines with a cut of 12 to 16 ft. required about 10 horses or a tractor of about 15 drawbar horsepower to pull them. About 1.6 gal. of fuel and 0.1 gal. of oil per acre were used in harvesting with a tractor-drawn combine equipped with an auxiliary engine. A gallon of fuel (gasoline or kerosene) per acre was consumed by the tractors, and 0.6 gal. of gasoline was used by the combine engines.

One man with a team headed by hand and ricked an average of 1.8 acres of grain sorghum, two men with a grain header and 8 or 10 horses averaged 13 acres, two men with a 15-ft. combine harvested and threshed an average of 23 acres, and two men with a row binder and four horses cut and shocked an average of 3.9 acres per day. Three or four men with a combine threshed an average of 200 bu. or more of headed grain sorghums per man per day. Five and six men with a separator threshed about the same quantities per day. Headers, combines, and separators were found to require considerable adjustment for the proper harvesting and threshing of grain sorghums.

Harvesting and threshing grain sorghums cost 3 cts. per bushel with the combine, 8 cts. with the header, 15 cts. with the row binder, and 10 cts. when harvested by hand. While cash costs are lower for the combine than for other methods of harvesting, this low cash cost is made possible only through the purchase and upkeep of an expensive machine.

Of 147 growers with grain sorghums harvested and threshed by all methods, 30 piled the grain on the ground, 50 stored in bins, 11 piled the grain on the ground and later stored in bins, and 26 hauled the grain directly to the elevator. Piling on the ground was the most effective way of drying the grain before marketing or storage.

Combined grain sorghum contained more moisture, foreign material, cracked grain, sand, and dirt than that headed and then threshed from the ricks. The average moisture content of grain sorghum harvested with a combine before frost was slightly higher in kafir and in milo considerably higher than that in grain harvested after frost.

Testing the sugar content of beets for genetical purposes, E. REED (*Plant Physiol.*, 4 (1929), No. 3, pp. 367-371).—In a method recommended for determining the sugar content of individual beets where desired for genetical study, wherein accuracy is essential, the normal weight (26.048 gm.) of the beet pulp is put into a lead subacetate solution (30° B.) of 177 cc., autoclaved at 15 lbs. for 15 minutes, and allowed to cool to room temperature. The solution is then filtered and the filtrate polarized.

Further experiments in the harvesting of burned cane, H. H. DODDS and P. FOWLIE (*So. African Sugar Jour.*, 13 (1929), No. 5, pp. 287, 289).—Another series of experiments (*E. S. R.*, 59, p. 630) largely repeated and confirmed results of the previous year. Similar relative differences were noted in the keeping qualities of burned and unburned sugarcane as in 1927, but the rate of deterioration was much slower for each because of earlier harvest (October, 1928) and cooler weather. Unburned cane deteriorated much faster than burned cane, especially if burned cane was left standing. Cane not burned must be taken to the mill as soon as possible after cutting, whereas burned cane may remain longer in the field. When more cane is burned than can be taken to the mill within 4 days the cane will keep best if left standing until transportation is available. The experiments apply only to Uba sugarcane, reputed for very good keeping qualities.

The agricultural value of hard seeds of sweet clover in Alberta, C. W. LEGGATT (*Sci. Agr.*, 9 (1929), No. 10, pp. 683-688).—Additional results on plats seeded to sweetclover in 1927 at Lacombe and Brooks, Alta. (*E. S. R.*, 58, p. 534), were recorded in the spring of 1928. Plants produced by hard seeds

appeared to be somewhat less winter hardy under unfavorable winter conditions than those from permeable seeds. This effect, however, appeared due to the fact that seedlings from hard seeds germinated too late in the season to become properly established to withstand the winter rather than to any inherent weakness in the seedlings themselves. Additional germination after the winter was contributed entirely by the hard seeds. Although hard seed had about 50 per cent of the agricultural value of the permeable seed during the first growing season, they about equaled the permeable over the whole period of the growing season of 1927 to late spring 1928.

A study of the efficiency of different materials for bagging tobacco flowers, M. M. DE LA CRUZ (*Philippine Agr.*, 18 (1929), No. 3, pp. 139-151, figs. 15).—Tests of 14 materials, principally leaves of tropical plants, showed that all were effective in preventing cross-pollination of tobacco except stems of boho bamboo, bamboo tubes, and dried leaves of *Aleurites moluccana*, of *Donax cannaeformis*, and of castor-bean. However, dried tobacco leaves blistered and cracked on hot days, and leaves of *Colocasia esculenta* rotted during the rainy season. Capsules developed normally inside the bagging materials, and seeds produced therein had high percentages of germination. Capsules developed from emasculated flowers always came from imported varieties.

Cigar-tobacco production in Pennsylvania, O. OLSON (*U. S. Dept. Agr., Farmers' Bul.* 1580 (1929), pp. II+22, figs. 10).—Superseding Farmers' Bulletin 416 (E. S. R., 24, p. 37), this publication gives information on the cropping systems, cultural methods, and harvesting and curing practices followed in growing cigar tobacco in Pennsylvania, plant diseases, seed selection, and the fermentation or sweating process.

Breeding hard red winter wheats for winter hardiness and high yields, K. S. QUISENBERRY and J. A. CLARK (*U. S. Dept. Agr., Tech. Bul.* 136 (1929), pp. 28).—In endeavors to develop hardier, high quality, and high yielding sorts of wheat, numerous crosses were made between hardy soft wheats, as Minhardi, Buffum No. 17, and Odessa, and high quality hard wheats, as Turkey, Kanred, and Kharkof. Seedlings of several filial generations of the hybrid material at stations in Kansas and California, and subsequently in North Dakota and Montana under more severe winter conditions, permitted selection of material appearing to meet the requirements.

Results obtained in nursery experiments at Dickinson, N. Dak., and Moccasin, Mont., covering four years, and from experiments in the uniform winter-hardiness nurseries seeded at 28 stations in the northern United States and in Canada covering three years, led to the conclusion that strains have been developed which are about as hardy as Minhardi, Buffum No. 17, and Odessa, in addition to possessing the ability to outyield these varieties and also the hard red winter wheats, Turkey, Kanred, and Minturki, in Montana and North Dakota. When tested in Kansas and Nebraska the best of these hybrid strains were found to be too late in maturity and therefore of little value for the central and southern sections of the Great Plains area. This seemed to indicate that the characters of winter hardiness and late maturity are associated. Plat tests at Dickinson, N. Dak., and at Havre and Moccasin, Mont., supplemented by milling and baking experiments, from one year's results suggest that the most outstanding of the strains may have promise for winter hardiness, high yield, and good milling and baking qualities.

See also an earlier note (E. S. R., 55, p. 35).

Removing smut from Pacific Northwest wheat by washing, E. N. BATES, G. P. BODNAR, and R. L. BALDWIN (*U. S. Dept. Agr. Circ.* 81 (1929), pp. 24, figs. 6).—According to the results of an investigation at Portland, Oreg., involving 140 car lots of smutty wheat, washing smutty wheat of the Pacific North-

west with either a single or a double cylinder wheat washer appears to be a highly desirable method of removing smut from wheat for commercial purposes (including milling and mixing with smut-free wheat), for domestic shipments, and for export.

Washing removed 86.9 per cent of the total weight of smut from the smutty wheat. The weight of smut removed constituted about 20 per cent of the total weight of material taken from the wheat by the washing process. In every case the washed wheat was pronounced free from smut dockage after the washing process. The actual foul dockage averaged 0.79 per cent before the wheat was run through a cleaner, 0.47 per cent after cleaning, and 0.36 per cent after washing. The average foreign material other than dockage present in the wheat, as received, was 0.19 per cent, after cleaning 0.11, and after washing 0.08 per cent. The moisture content of the wheat as received at the elevator ranged from 8.16 to 10.15 per cent and averaged 8.64 and after washing ranged from 10.1 to 11.95 per cent and averaged 10.78. The loss in test weight between the smutty wheat as received and the washed wheat after short temporary storage ranged from 0.1 to 2.7 lbs. per bushel in the various lots and averaged 0.7 lb. Of the 140 car lots washed, 115 were of the same numerical grade after washing as before, and 25 were one numerical grade lower. In each case the grading factor which determined the grade in all the wheat was its test weight per bushel.

The washer had only a slight tendency to crack the wheat, resulting in an increase of 1.76 per cent of cracked grains based on the weight of the wheat as received. Before being washed the wheat showed a germination ranging from 91.5 to 99 per cent, averaging 95.4, and after washing a germination ranging from 87.5 to 94.5 per cent and averaging 90.7. The washing process increased the gross weight of the wheat by 1.35 per cent, and the gain in weight of the merchantable wheat, due to washing, was 2.6 per cent. A loss of dry matter equal to 1.02 per cent of the weight of the wheat entering the washer was the result of washing. The total cost of labor, power, and water was 0.364 cent per bushel, or 12.13 cents per ton of smutty wheat washed, of which 26 per cent was for power, 11 for water, and 63 for labor. The estimated gain in value of the wheat due to the washing process would net the merchandiser an average profit of 81.1 cents per ton or about 2.5 cents per bushel.

The process is described in detail, and the advantages of removing smut from wheat are indicated.

Proceedings of the eighteenth annual meeting of the Association of Official Seed Analysts of North America (*Assoc. Off. Seed Anal. North Amer. Proc.*, 18 [1925], pp. 68, figs. 26).—A report of the activities of the association during 1925 and of the eighteenth annual meeting at Kansas City, Mo., from December 29 to 31, 1925. The following papers were presented: Some Phases of Seed Law Enforcement, by C. N. Smith (pp. 23-25); Some Experience with Seed Control in Canada, by G. H. Clark (pp. 25-27); The Essentials of a Seed Germination Chamber (p. 27), Greenhouse and Chamber Tests of Ryegrasses by Months (p. 28), and Germination of Hard Seeds of Hairy Vetch (p. 42), all by W. L. Goss; The Interpretation of Germination Tests, by E. Brown (pp. 28, 29); Some Variations Among Results of Germination Tests, by F. S. Holmes (pp. 29-32); The Use of Catalase as a Means of Determining the Viability of Seeds, by W. E. Davis (pp. 33-39); Comparing the Candle-grass Method with Other Methods of Germinating Seeds, by Mrs. E. P. Harling (pp. 40, 41); The Hard Seed Problem to Date, by D. Schmidt (pp. 42, 43); Studies in the Germination of Celery Seed, by E. F. Hopkins (pp. 47-49); Corn Germination Study, by M. L. Spracher (pp. 50-54); Comparing Laboratory and Field Viability Tests of Seed of Garden Peas, by M. T. Munn

(p. 55); A Discussion of an Abnormal Sprout Occurring in Onion Seed Germination, by G. M. Cole (pp. 56-62); The Identification of Seeds of White and Yellow-Flowered Sweet Clover, by O. A. Stevens and H. D. Long (p. 62); The Seeds of Quack Grass and Certain Wheat Grasses Compared, by H. H. Henry (p. 63); Comparative Values of Alfalfa Seeds of Different Shapes, by S. C. Miller (pp. 63, 64); Working Libraries of Our Seed Laboratories, by A. H. Ferguson and E. P. Emack (pp. 64-66); and Some Notes on Calculating and Reporting Results of Referee Work, by O. M. Kelk and R. M. Mostyn (pp. 66, 67).

Proceedings of the nineteenth and twentieth annual meetings of the Association of Official Seed Analysts of North America (*Assoc. Off. Seed Anal. North Amer. Proc.*, 19-20 [1926-27], pp. 82, figs. 37).—The activities of the association and of its committees during 1926 and 1927 are reviewed.

Papers presented at the nineteenth annual meeting at Ithaca, N. Y., from August 16 to 23, 1926, included Legislation as Applied to Seed Control, by G. T. French (pp. 10-13); The Botany of Seed Testing, by F. H. Hillman (pp. 15-24); Artificial Drying and Low Temperature as Means Employed in Obtaining an Increase in Germination of Some Vegetable Seeds, by W. J. Franck and G. Wieringa (pp. 24-27); Further Studies of Corn Germination, by M. L. Spracher (pp. 27-34); Viability of Field Peas After Being Treated by Para-Di-Chlor-Benzene in Varying Amounts and for Varying Periods of Time, by C. F. Burgess (pp. 34, 35); Notes on Some Phases of Beet Seed Germination, by M. Jackson (pp. 35-37); and Investigation into the Agricultural Value of Hard Seeds of Alfalfa Under Alberta Conditions, by C. W. Leggat (pp. 37-39) (*E. S. R.*, 59, p. 627).

The following papers were presented at the twentieth annual meeting at Detroit, Mich., from June 28 to 30, 1927; Seed Laws and the Seed Analyst, by A. L. Stone (pp. 48-50); Differences Between European and American Methods of Seed Testing (pp. 50-52), and Means of Identifying Red Fescue and Sheep's Fescue (pp. 56, 57), both by K. Leendertz; Hardshell of Beans: Its Production and Prevention Under Storage Conditions, by W. O. Gloyer (pp. 52-55); The Development of the Hilum in *Salvia*, by S. L. Neville (pp. 57-62); Crimson Clover Tests, by K. E. Smith (pp. 62-64); The Analyzing and Subsequent Labeling of Timothy and Alsike Clover Mixtures (pp. 64-66); The Behavior During Germination of Cracked and Broken Seeds from Badly Threshed Red Clover Seed (pp. 68, 69), and The Growth Response of Seeds Treated with Cathode Rays (p. 70), all by M. T. Munn; Germination of Peas: Comparison of Laboratory and Field Tests in Montana, by W. D. Hay (pp. 66, 67); Further Studies of Celery Seed Germination, by E. F. Hopkins (pp. 69, 70); Germination of Brassicas (Vegetable), by L. Thurlimann (pp. 71-74); The Problem of Making Germination Tests of Scarified Seed, by W. O. Whitcomb (pp. 74-81); and Germination of Carpet Grass, by M. E. Woodbridge (pp. 81, 82).

Weed distribution and crop character in relation to soil type in Saskatchewan, A. H. JOEL (*Sci. Agr.*, 9 (1929), No. 10, pp. 675-682).—Marked differences were observed in the adaptation of many weeds in the course of soil surveys in Saskatchewan. The dominance or general occurrence of weeds, both for major belts and on soil types, seemed to be explainable by differences in moisture efficiency. The greatest variety of weeds, as well as of natural vegetation, seems to occur in the dark brown prairie belt, transitional between the more moist and the drier parts of the Province. Poverty weed in Saskatchewan seems best adapted to moderately moist, slightly alkaline places on the Sceptre clay where *Agropyron smithii* grows well.

Organic food reserves in relation to the eradication of Canada thistles, F. A. WELTON, V. H. MORRIS, and A. J. HARTZLER (*Ohio Sta. Bul.* 441 (1929)

pp. 25, figs. 8).—Examination of roots of Canada thistle (E. S. R., 58, p. 434), gathered at Wooster in 1925, 1926, and 1927 showed that the percentage of organic food reserves, i. e., the carbohydrates and nitrogen compounds utilized by the plant itself in the processes of maintenance and growth, varied with the season of the year. The percentage gradually declined during spring while vegetative growth was proceeding rapidly and reached a minimum about June 1, after which it gradually increased as the season advanced.

Mowing the thistles delayed the storage of food reserves and thereby appeared to cause the death of many of the weaker plants. Mowings made regularly a month apart and continued through four seasons removed practically all of the thistles. When begun June 1, four mowings were slightly more effective than three mowings, which in turn gave decidedly better results than two mowings. Three mowings, starting July 1, were slightly less effective than three mowings begun June 1 but superior to two mowings, cutting first on June 1. One mowing made when the plants were in full bloom seemed to injure the plants only slightly.

Goat grass, a weed pest of central Kansas wheat fields, J. H. PARKER (*Grain Dealers Jour.*, 63 (1929), No. 5, p. 313, figs. 6).—Goat grass (*Aegilops cylindrica*) is described as a serious weed pest in central Kansas, especially in fields where wheat is grown continuously. It is said to serve as a host for wheat rust and has a serious dwarfing effect on wheat, and natural crosses between goat grass and wheat have been recorded. Crop rotation, even alternation of wheat with corn or sorghum, clean cultivation, or seeding the infested land to alfalfa are among the control measures suggested. See also another species described by Kennedy (E. S. R., 61, p. 227).

HORTICULTURE

[Horticultural investigations at the Alaska Stations], H. W. ALBERTS (*Alaska Sta. Rpt.* 1928, pp. 3-8, 9, 14, 15, figs. 3).—In the customary manner (E. S. R., 60, p. 736) brief notes are presented on the results of varietal and cultural tests with fruits, vegetables, and flowers.

At the Sitka Station among tree fruits the Montmorency and Wragg cherries set abundantly, but wet weather caused cracking of the fruits before ripening. A total of 591 varieties of strawberries were tested, two of which bloomed on May 2. Currants and gooseberries were the most satisfactory bush fruits. Jerusalem artichokes wintered satisfactorily in the open ground but failed to produce as heavy crops as did potatoes. As usual all of the semihardy types of vegetables proved highly satisfactory.

At the Fairbanks Station Cuthbert raspberries heavily mulched with straw wintered safely and bore a large crop of excellent fruit. As at the Sitka Station, semihardy types of vegetables gave excellent results.

[Horticultural investigations at the Mississippi Station], J. C. C. PRICE and H. F. WALLACE (*Mississippi Sta. Rpt.* 1928, pp. 32, 33, 59, 60).—Continuing the tomato breeding project discussed in the preceding report (E. S. R., 62, p. 38), Gold Ball, a yellow tomato free from cracking and greenness at the stem end, was used as a parent. In blueberry propagation the time of taking cuttings was found influential, but individuality in response of cuttings from each parent plant was so marked as to render results highly inconsistent. Lack of acidity or excess moisture in the soil were unfavorable to blueberry cuttings. Variety tests with fruits and vegetables were continued, and apples are classified according to their susceptibility to blight. Borers were completely eradicated from young peach trees by paradichlorobenzene.

At the Raymond Substation varietal and fertilizer tests continued to be the principal horticultural activities. Among 12 varieties the Gulf States tomato was most productive. For tomatoes 1,500 lbs. of an 8-5-3 (P-N-K) fertilizer gave most profitable yields. Urea was again the most promising source of nitrogen for tomatoes. The results of shipping tests of tomatoes fertilized with varying amounts of nitrate of soda are discussed. Potash apparently contributed to sturdy growth and increased color. For garden peas and beans 1,000 lbs. per acre of a 10-3-3 mixture again gave best results, with nitrate of soda slightly best for peas and sulfate of ammonia for beans. For cabbage 1,500 lbs. per acre of a 10-4-4 mixture was most effective.

[Horticulture at the Hettinger Substation], C. H. PLATH (*North Dakota Sta. Bul. 229 (1929), pp. 24, 25, fig. 1*).—Brief notes are presented on the results of tests of shade trees and of garden vegetables.

[Horticulture at the Langdon, N. Dak., Substation], V. STURLAUGSON (*North Dakota Sta. Bul. 228 (1929), pp. 13, 14, 23, 30, 31*).—Notes are presented on the results of miscellaneous tests with vegetables and bush fruits. In 1927 Earliana was the earliest ripening, highest yielding, and the most uniform of five varieties of tomatoes tested, while in 1928 in a comparable test with seven varieties Agassiz was the most productive. Comparing 2 and 3 bu. of seed per acre for the Alaska and Advancer peas, approximately 50 per cent larger yields resulted from the heavier seeding. The majority of Latham raspberry canes of plants set in 1927 were killed the subsequent winter. Some data are presented on cabbage and broadbean varieties.

[Horticulture at the Porto Rico Insular Station], M. T. COOK, P. OSUNA, and P. GONZÁLEZ RÍOS (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt. 1928, Eng. ed., pp. 19, 20, 44-51, 51-58*).—Brief comments are made upon the results of varietal, cultural, and propagation tests conducted by Osuna on various fruits, vegetables, and ornamental plants and upon coffee experiments conducted by González Ríos. In the case of coffee tabulated data on yields obtained in three cooperative fertilizer tests are presented.

Experimental work on cantaloupes, J. B. EDMOND (*Veg. Growers' Assoc. Amer. Ann. Rpt. 1929, pp. 83-88*).—This is a brief summary of investigations conducted by the Michigan Experiment Station.

Bordeaux mixture was found more effective in disease control than was copper lime dust. Fertilizing in the hill with 300 lbs. of chemical fertilizers per acre proved more effective than did 600 lbs. broadcasted. Manure gave excellent results on soils deficient in humus, but in general commercial fertilizer proved more effective.

Quality in melons was found to be determined by the percentage of total solids, which in turn depended largely on the sugar content. Bright, sunny weather with a moderate rainfall favored quality. Melons grown on fertilized and sprayed vines possessed higher percentage sugar content than did those of control plants, it being apparent that any treatment which tended to keep the plants growing vigorously was an aid to quality.

Normal mushrooms from artificial manure, E. B. LAMBERT (*Science, 70 (1929), No. 1805, pp. 126-123*).—Attempts to utilize synthetic manures made from straw as the bulk material in cultural media for mushroom growing met with varying success. The best of the synthetic manure beds yielded only about half that of composted horse manure. The variability occurring within the synthetic series is deemed the result of differences in the microbial flora. The horse manure beds were quite uniform in acidity reaction, being normally alkaline, while the synthetic manure beds were highly variable in this respect. From a practical viewpoint the results are considered unfavorable.

Paprika, a Hungarian article of export [trans. title], E. OBERMAYER (*Kisérlet. Közlem.*, 31 (1923), No. 4, pp. 457-469).—This contribution from the Agricultural Chemistry and Paprika Experiment Station in Szeged discusses production factors, properties of paprika, and regulations against adulteration and for the maintenance of quality.

The influence of bright sunshine upon the tomato under glass, W. F. BEWLEY (*Ann. Appl. Biol.*, 16 (1929), No. 2, pp. 281-287, figs. 5).—Plotting the yields observed at the Experimental and Research Station, Cheshunt, England, over an 11-year period on greenhouse-grown tomato plants and the total sunshine hours occurring during the growing seasons of the same period, it was observed that the two curves followed the same general trends. Checking sunshine hours with yields of various fertilizer plots, it was observed that sunshine in some way influences the potassium needs of the tomato plant, less potassium being required during bright, sunny weather.

Fruit and vegetable storage, L. P. MCGUIRE (*Trop. Agr. [Trinidad]*, 6 (1929), No. 10, pp. 279-284).—A summary is presented of current literature dealing with the optimum storage and transport temperatures for a large number of fruits and vegetables.

Progress report on fruit breeding, G. T. SPINKS (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt. 1928*, pp. 17-22).—As previously reported (E. S. R., 60, p. 41), in many instances apple seedlings tended to closely resemble their ovule parent, notably in seedlings of the Lord Derby, Bismarck, Jonathan, Wealthy, and Frogmore Prolific varieties. This resemblance was not so marked in seedlings of Allington Pippin and was rare in Cox Orange Pippin progenies. The Court Pendu Plat apple was a prepotent parent. Further crosses made during the year included Worcester Pearmain×McIntosh Red and Worcester Pearmain×Delicious. Some promising pear seedlings were secured from crosses of Louise Bonne of Jersey×Conference and William Bon Chretien×Conference. Notes are given on the breeding of plums, black currants, raspberries, blackberries, and strawberries.

Factors governing fruit-bud formation.—IX, Some observations upon the leaf area of spurs on biennially bearing apple trees, T. SWARBICK (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt. 1928*, pp. 23-38).—In this study on factors governing fruit bud formation (E. S. R., 60, p. 43), leaf count and leaf area measurements taken on large biennially fruiting apple trees at the Long Ashton Research Station showed a definite relationship between leaf area and blossom bud formation. In the case of two Court Royal apple trees fruiting in alternate years it was found that the number of spur leaves per spur was 50 per cent greater in the off year than in the on year. At the same time the areas of these leaves were from 300 to 400 per cent greater in the off years, increased leaf size thus accounting in large part for the differences. The average number of leaves per spur was the same for the two trees in their off years and on years despite the alternation of bearing. Total leaf area per spur, including bourse buds, was only half as much in the on year as in the succeeding off year. The spur leaf area of the on year was only about one-fourth that of the same spurs in the off year. Leaf area of nonbearing spurs in the on year was larger than that of flowering spurs of the same tree but less than the leaf area in the off year, probably accounting for their inability to develop fruit buds.

Apparatus for the determination of carbon dioxide in the respiration of apples, P. L. HARDING, T. J. MANEY, and H. H. PLAAGE (*Science*, 70 (1929), No. 1805, pp. 125, 126, fig. 1).—Descriptive notes are presented on the apparatus and its operation.

Pear survey of the United States and Canada, R. W. REES ([*Rochester*]: *N. Y. Cent. Lines, Dept. Agr. Relat.*, [1929], pp. 41, figs. 15).—In the same manner as that for the apple (*E. S. R.*, 54, p. 644), the author presents a regional survey of pear production in the United States and Canada, with notes on varieties, future prospects, and other factors of importance.

Correlations between growth and fruit production of apricots, H. S. REED (*Amer. Soc. Hort. Sci. Proc.*, 25 (1923), pp. 247-249).—Based on records taken at the Citrus Experiment Station, Riverside, Calif., from 1920 to 1923 on a 4-acre orchard of apricots divided into 10 plats of 20 trees each, certain correlations are presented. Between severity of pruning and growth there were found positive and rather large correlations. The effect of pruning on the size of fruits showed a progressive change. In 1922 smaller fruit was associated with heavy pruning. In the next two years there was no effect, following which fruit size increased with increased severity of pruning. Significantly positive *rs* were obtained in only three years, 1923, 1924, and 1925, between weight of wood removed and yields, indicating that yield in the apricot is largely conditioned by factors in the lower part of the tree. Trunk growth and fruits per pound gave negative correlations, significant, however, only in the years 1922, 1925, and 1926. Correlation between yield and number of fruit per pound was not strikingly positive, being significant in only four out of seven years. Growth of trunk of one year and yield the next gave significant correlations in all except one season. Yields and trunk growth of a single year were not significantly correlated.

Strawberry variety identification, J. G. MAYNARD (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.* 1928, pp. 60-66, pl. 1).—Certain botanical characters found at the Long Ashton Research Station to be useful in the identification of strawberry varieties include the type of pubescence on the petiole, the color of stipules, color of foliage, smoothness of leaflet surface, leaflet shape, pubescence on the leaflet surface, presence or absence of a channel in the petiole, general habit of growth, and number of leaflets. Several flower and fruit characters are also mentioned.

The Blakemore strawberry, G. M. DARROW and G. F. WALDO (*U. S. Dept. Agr. Circ.* 93 (1929), pp. 10, pls. 2, figs. 6).—A technical description, accompanied by colored plates and other illustrations, is offered of a new strawberry, Missionary×Howard 17, originated at the U. S. Plant Field Station near Glenn Dale, Md. A comparison of the new variety, Blakemore, with Missionary, Klondike, and Howard 17 showed Blakemore to be exceptionally vigorous and productive, and because of its easy picking and capping qualities, bright light red color, tough skin, firm flesh, solid center, acidity, high pectin content, and excellent flavor to be highly desirable for preserving.

Handbook upon grape growing, M. ARTHOLD (*Handbuch des Weinbaues. Vienna: A. Hartleben, 1929, pp. XII+368, figs. 149*).—This is a general discussion upon the physiology of growth, methods of propagation, cultural aspects, methods of pruning and training, control of pests, etc., from the viewpoint of the vinifera grape.

The effect of dormant pruning on the carbohydrate metabolism of Vitis vinifera, A. J. WINKLER (*Hilgardia [California Sta.]*, 4 (1929), No. 6, pp. 153-173, figs. 9).—Having recorded certain harmful effects of severe dormant pruning on the vinifera grape (*E. S. R.*, 35, p. 440), determinations were made in the present study of the changes in reducing substances and starch in the shoots, trunk, and roots of vines pruned in four ways, namely, (1) nonpruned, part of clusters removed, (2) cane pruned, part of clusters removed, (3) spur pruned, no clusters removed, and (4) severely pruned, no clusters removed.

In general, decreases in pruning were correlated with increases in the amount of carbohydrate. Two maxima in total carbohydrate, occurring, respectively, in the dormant season and in the early growing season, were observed in unpruned vines, whereas in severely pruned vines only one maximum was noted. With a decrease in pruning, the amounts of total carbohydrates were increased at each maximum, the percentage increase being greater at the early summer high point. This increase was primarily, if not entirely, sugars. The influence of pruning on carbohydrate content during early summer was confined primarily to the shoots.

Weights taken after pruning showed that nonpruned vines were more than three times as heavy as normally pruned vines, with comparable differences in content of sugars and total carbohydrates. The ratio of weight of shoots to total weight of vine following pruning showed the nonpruned vines to have made relatively less shoot growth, but the ratio of weight of leaves to shoots was much greater in the nonpruned vine. Time of growth was materially influenced by pruning, the nonpruned vines making a more rapid early development but slowing down about July 1, while pruned vines continued growing much later. Rapid early growth resulted in an increased leaf surface for nonpruned vines equivalent to a considerable increase in the season of leaf activity.

Controlling carbohydrate nutrition by defoliation on one hand and blossom cluster thinning on the other, the author found a positive correlation between the number of leaves per vine and the sugar content of the mature flowers. A positive correlation was also noted between the number of leaves per vine and the setting of berries and the development of the fruit. Accompanying the increase in sugar content of the mature flowers was a marked increase in pollen viability, suggesting a positive relation between carbohydrate nutrition and the male as well as the female parts of the flowers. A decrease in the number of leaves per vine was accompanied by smaller production, lighter clusters, lower number of normal berries per cluster, decrease in the weight of berries, etc.

Studies of grapes in cold storage, F. J. DE VILLIERS (*So. African Jour. Nat. Hist.*, 6 (1929), No. 4, pp. 315-329).—In this study of the factors influencing the keeping of grapes it was found that natural variability in a single variety grown in a given location was such that 127 bunches, or about 8 boxes, to a single sample were necessary to give significant results in making comparison. Dividing grapes into three classes as regards maturity, namely, greenish, ripe, and ripe +, it was observed that neither the greenish grapes nor the ripe + kept as well as those in ripe condition. The greenish grapes failed to sweeten in storage and wilted readily. Analyzing the three classes, there was found a marked decrease in titrable acidity with maturity with very slight H-ion changes, due apparently to the buffer action of the cell sap. There was a close parallelism between acidity changes and respiration rate. Katabolism was evidently much higher in the immature fruit. The inferior keeping quality of the ripe + grapes is ascribed in part to the decrease in pedicel attachment which probably allowed the entrance of fungi.

The place of production was a factor in storage, also variety and the manner in which the pedicel was attached. Studies of chemical composition of grapes showed no significant differences due to soil, nor was any correlation observed between chemical composition and good keeping qualities. The apparent inherent keeping quality of varieties is associated with the impregnation of the cell walls with pectic bodies or intercellular apposition of pectic substances which not only give firmer structure but probably increase the reserves for metabolic activity.

Grapes picked in the morning kept best. Slight wilting before packing proved beneficial, especially in tender varieties. Porous sulfite paper proved a satisfactory wrapping medium. Grapes reached their highest turgidity just before sunrise and their lowest about 2 p. m. The rapid loss of turgidity was found due to the leaves drawing on the fruit for moisture. Ripe grapes suffered least on account of their higher osmotic concentration. It is assumed that the vine is unable to conduct sufficient water at such times. Rain during harvest caused bursting of berries, especially of the thick-skinned varieties. The two principal factors concerned in bursting are deemed to be elasticity of the skin and the osmotic pressure of the pulp cells. Such cracking usually occurred across sunburn or russet spots.

The rate of respiration varied directly with temperature; hence storage temperatures decreased the draft on reserves. The relation between temperature and respiration was found to be fairly constant, irrespective of variety. It is pointed out that low temperature also retards and in many cases inhibits the growth of fungi. For example, common mold showed maximum growth at 27° C. and very slight at 0°. Grapes having a high acidity or high tannin content in the subepidermal layers were less readily injured by fungi.

In a study of the effect of low temperatures on grapes, two varieties, Rosaki and Raisin Blanc, were placed in an air bath at -10° C. It was observed that grapes were very sensitive to low temperature, being injured at less than 32° F. Undercooling had no harmful effects when the fruits were slowly warmed. Chemical analysis failed to show any appreciable reduction in acidity in cold storage, and the sugar-acid ratio was only slightly disturbed. It is concluded that the loss of quality in storage is due to the absence of aromatic esters, which, the author believes, are not manufactured at low temperature. The appreciable loss of water in storage caused an increase in the percentage of sugar and acids. The Hanepoot variety kept from 2 to 3 months and the Rosaki 3 to 4 months, after which there was a rapid breaking down. It is pointed out that an accumulation of carbon dioxide in storage results in the production of undesirable fruit substances, such as acetaldehyde and ethyl alcohol, which cause disorganization of the tissue.

Effect of boron on growth of citrus, A. R. C. HAAS (*Calif. Citrogr.*, 14 (1929), No. 9, p. 355, figs. 2).—That citrus trees, grapefruit, lemon, and orange, require minute quantities of boron for their proper development was indicated in sand culture experiments conducted at the Citrus Experiment Station, Riverside, Calif. The absence of traces (one at a time) of aluminum, iodine, titanium, bromine, strontium, lithium, manganese, and ammonium, on the other hand, had no apparent ill effect. It was evident that boron in larger quantities was distinctly toxic.

Washington Navel pruning and girdling experiments, A. D. SHAMEL (*Calif. Citrogr.*, 14 (1929), No. 9, pp. 355, 376, 382, fig. 1).—Further data (E. S. R., 41, p. 241) presented on the yields of Washington Navel orange trees from 1915 to 1929, inclusive, show but little variation in yield between pruned and unpruned trees, although the pruned trees generally averaged slightly lower. Girdling of Washington Navel trees on March 30 and April 20, 1928, by the knife-edge method caused little if any difference in yields in 1929 that could be attributed to the treatment, although a tendency was noted for the girdled trees to produce a slightly larger proportion of desirable commercial sizes. No differential effect due to the season of girdling was noted.

Observations on the dwarf coconut palm in Malaya, H. W. JACK and W. N. SANDS (*Malayan Agr. Jour.*, 17 (1929), No. 6, pp. 140-165, pls. 7, fig. 1).—Three races characterized by ivory yellow, apricot red, and green fruits, respec-

tively, are described and their production compared with that of standard varieties. In general the dwarfs, particularly the green-fruited race, gave highly promising results.

Pecan growing in Texas, J. S. WOODWARD, L. D. ROMBERG, and F. J. WILLMANN (*Tex. Dept. Agr. Bul. 95* (1929), pp. 182, pls. 8, figs. 73).—General information is offered on culture, propagation, varieties, fruiting habits, pest control, etc.

The culture of greenhouse chrysanthemums, W. W. WIGGIN (*Ohio Sta. Bul. 439* (1929), pp. 35, figs. 8).—A general discussion upon the culture and handling of chrysanthemums.

Comparing several rooting media, such as sand, slag, and combinations thereof, for growing cuttings, good results were obtained with all materials, leading to the conclusion that care in the cutting bench is of greater importance than the growing medium. Certain varietal differences were noted in capacity to root. Measurements of the diameter of blooms and of stem length in White Turner plants grown in raised benches and raised beds showed distinctly in favor of raised bed culture. Even more significant results were secured with pompons. No material advantage was secured from fresh soil in raised bed culture for either large chrysanthemums or pompons, especially where steam sterilization was available. Within the pH range of 5 to 8.5 no material effect of soil reaction was noted on diameter of bloom or length of stem.

In fertilizer studies sulfate of ammonia gave the longest stems in 1927 and 1928 but was closely followed by several other nutrients. Peat moss gave promising results as a soil modifier. Time of application studies suggested that slowly available fertilizers should be applied before plants were set and that rapidly available forms should be used after setting. In general, pompons did not respond as favorably to fertilizers as did the large-flowered types. No significant difference was noted in the keeping quality of flowers as influenced by fertilizer treatment. Soluble nitrogen tended to delay blooming slightly.

With cuttings from healthy mother plants no material differences were recorded in the length of flower stems, whether from high or low producing parents. No appreciable correlation was found between the length of stems and the diameter of blooms in the William Turner and Yellow Turner varieties, suggesting that any stem growth beyond that needed for commercial purposes is of no importance. In the case of pompons, a slight positive correlation was noted between the number of shoots and the length of stems.

Descriptive data on varieties are presented in tabular form.

The chrysanthemum, A. HERRINGTON (*New York: Orange Judd Pub. Co., 1929, rev. ed., pp. VIII+158, figs. 32*).—A revision of a book previously noted (*E. S. R.*, 17, p. 770).

Sweet peas: Their history, development, culture, C. W. J. UNWIN (*Cambridge: W. Heffer & Sons, 1929, 2. ed., pp. XI+192, pls. 14, figs. 4*).—This is a revision of a book previously noted (*E. S. R.*, 55, p. 839).

The book of the tulip, A. D. HALL (*London: Martin Hopkinson, 1929, pp. 224, pls. 24*).—A general treatise on the botany, breeding, culture, and propagation.

Lily, iris, and orchid of southern California, F. M. FULTZ (*Gardena, Calif.: Spanish Amer. Inst. Press, 1928, pp. 135, figs. 66*).—A general discussion.

Rock gardens, A. EDWARDS (*London and Melbourne: Ward, Lock & Co., 1929, pp. 320, pls. 40, figs. 8*).—General information is presented on the planning and planting, with sections on wall, paved, marsh, and water gardens.

Landscape gardening in home beautification, W. KENNEDY (*Mississippi Sta. Bul. 267* (1929), pp. 41, figs. 22).—A general discussion concerning the planning, planting, and care of home grounds with the idea of developing the

maximum beauty. Among subjects discussed are the arrangement of parts for small home grounds, the formal garden, the informal garden, roses and rose gardens, garden architecture, lawns, and plant materials and their care.

Transplanting trees and shrubs, F. L. MUIFORD (*U. S. Dept. Agr., Farmers' Bul. 1591* (1929), pp. II+34, figs. 31).—A general discussion of the principles and practices of transplanting, ranging from the small shrub to the full-sized tree.

FORESTRY

[Forestry at the Coastal Plain Substation], S. W. GREENE (*Mississippi Sta. Rpt. 1928*, pp. 62, 63, 64).—Five years' observations on the effect of grazing on longleaf pine reproduction suggested that grazing had not interfered seriously with survival of seedlings, except on areas of carpet grass where grazing was very close. Grazing reduced the fire hazard. Estimates of the number of seeds falling per acre where seed trees were plentiful were as high as 80,000.

A forest policy for North Carolina, J. S. HOLMES (*Jour. Elisha Mitchell Sci. Soc.*, 45 (1929), No. 1, pp. 23-36).—A policy is outlined in which a substantial extension in public ownership supplemented by tax relief on growing timber, increased fire prevention, and a State tree nursery are proposed.

Planting and care of shelter belts on the northern Great Plains, R. WILSON (*U. S. Dept. Agr., Farmers' Bul. 1603* (1929), pp. II+13, figs. 5).—Based on results obtained in extensive cooperative investigations, information is presented on the planning, planting, and management of shelter belt plantations. A list is given of species which have proved adaptable to the region, with suggestions to the effect that a combination of two or more species gives better results than does a single kind. Green ash, American elm, boxelder, Siberian pea-tree, Black Hills spruce, and western yellow pine were found desirable species. In broadleaf trees well-grown seedlings from 1 to 2 years old and 12 to 24 in. tall are considered the best size for planting, while in evergreens seedlings from 6 to 12 in. in height are suitable. Protection and cultivation during the early years were found essential.

How full stands of pulpwood may be grown, M. WESTVELD (*Canada Lumberman*, 49 (1929), No. 20, pp. 44-46, figs. 5).—A contribution from the Northeastern Forest Experiment Station, Amherst, Mass.

The distribution of the red beech in Austria [trans. title], L. TSCHERMAK (*Mitt. Forstl. Versuchsw. Österr.*, No. 41 (1929), pp. VIII+121, pls. 4).—This is a contribution upon the biology and silviculture of the beech, particularly with reference to its distribution as controlled by calcareous soils.

Basket willow culture, A. FANSON (*Korbweidenbau*, Berlin: Paul Parey, 1929, pp. 144, figs. 20).—This is a practical discussion on soils, varieties, propagation, manuring, utilization, etc.

DISEASES OF PLANTS

History of phytopathology and plant protection, E. MEYER (*Beitrag zur Entwicklungsgeschichte der Phytopathologie und des Pflanzenschutzes*, Inaug. Diss., Landw. Hochschule, Berlin, 1928, pp. 77+1).—This developmental history of phytopathology and plant protection, with special reference to some plant diseases, is a doctor's thesis presented to the agricultural high school at Berlin.

Diseases of cultivated plants, T. LINDFORS (*Sjukdomar hos våra Odlade Växter*, Stockholm: P. A. Norstedt & Sons, 1927, pp. 109, pls. 20, fig. 1).—The first section of this booklet deals systematically but briefly with the several diseases of the more commonly cultivated plants, their symptoms, and the

appropriate treatments. The second part deals somewhat generally with the various protective measures, media, and methods. An index is given containing the Swedish names of diseases, with the (parenthesized) Latin names of the causal organisms.

Plant pathology [California], D. G. MILBRATH (*Calif. Dept. Agr. Mo. Bul.*, 16 (1927), No. 12, pp. 659-663).—Brief accounts are given regarding the control, by the use of sulfur dust, of cantaloupe powdery mildew (*Erysiphe cichoracearum*); a study of tomato late blight, which was more destructive and widespread in 1927 than in 1926; hot water tests with gladiolus bulbs infested with the root-knot nematode (*Heterodera cacionema rad.cicola*), which were successful when applied at 110° F. for 2 hours, or 115° for 40 minutes; pomegranate fruit spot (*Alternaria* sp., and occasionally *Sterigmatocystis niger* present); a pear condition similar to bitter pit or identical therewith; soil analyses for root-knot nematode (*H. rad.cicola*); an effective hot water treatment of narcissus bulbs for *Tylenchus dipsaci*; cotton plant root rot (*Phymatotrichum omnivorum*), boll rots (*Aspergillus niger* and *Alternaria* sp.), sore shin (*Fusarium* spp.), and frosty mildew (*Ramularia areola*); the avoidance, by the use of high powered spray machinery, of spray residue of Bordeaux mixture on celery; the infestation of peach trees with *H. rad.cicola*; alfalfa wilt (*Aplanobacter insidiosum*); palm bud rot disease, outbreaking in *Phoenix canariensis* and possibly threatening *P. dactylifera*; and laboratory diagnoses, including *Gymnosporangium photiniae* on *Photinia arbutifolia*, *Thielavia basicola* causing damping-off in almond seedlings, *Pseudoperonospora cubensis* on *Cucumis melo* varieties, *Macrosporium cucumerinum* on melon leaves, mosaic on *Lilium formosum* in the greenhouse on imported bulbs, *A. insidiosum* on alfalfa, and *H. rad.cicola* found for the first time on pistachio roots.

Annual report of plant pathology department, D. C. NEAL and H. H. WEDGORTH (*Mississippi Sta. Rpt.* 1923, pp. 34-39).—In addition to work previously noted (*E. S. R.*, 59, pp. 36, 544, 846; 60, p. 151), condensed reports are given of work in progress at the station.

Experiments on the effect of virus diseases on the yield of Green Mountain potatoes gave the following yields per acre: Healthy potatoes, 89.2 bu.; mild mosaic, 63.6; rugose mosaic, 27; leaf roll, 18.7; and spindle tuber, 40 bu. Selections of mosaic-diseased Nancy Hall sweetpotatoes yielded from 30 to 70 per cent of the quantity produced from apparently healthy plants.

Treating cabbage seed with corrosive sublimate (1-1,000) for 10 minutes or for 25 minutes in hot water (50° C.) reduced the percentage of plants attacked by blackleg and increased the yield.

Experiments conducted during 1927 are said to indicate that organic mercury dusts controlled *Rhizoctonia* sp. and *Macrophoma phaseoli*, which cause stem and root rots of beans.

A root rotting of narcissus, from which a species of *Fusarium* was isolated, is reported.

In investigations of cotton diseases it is reported that four short and three long staple varieties have shown a high degree of resistance to cotton wilt. Resistance to anthracnose is claimed to be relative with varieties tested by inoculations. Dust and liquid seed treatments of cottonseed are said to have given increased yields over untreated seed at the Holly Springs Branch Station. Experiments with various kinds of potash and organic soil treatments for the control of rust are reported to have resulted in increased yields of cotton.

In variety tests of alfalfa resistant to anthracnose, six varieties or strains were found to possess some resistance to the disease.

Cayana-10 and Canal Point 81 sugarcane varieties are said to have shown marked resistance to mosaic.

A new bean root rot apparently caused by a species of *Fusarium* is reported.

[Work in plant pathology and botany at the Porto Rico Insular Station], M. T. COOK (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt. 1928, Eng. ed., pp. 24, 25, 59-66*).—Brief accounts are given on various plant disease investigations carried on at the station, and a list is given of diseases of various economic plants, with notes on their importance.

Internal therapy in plant pathology [trans. title], L. PETRI (*Nuovi Ann. Agr. [Italy], 7 (1927), No. 3, pp. 347-358*).—Of methods indicated as possible bases for internal therapy as applied in vegetable pathology, the only one thought to promise advantage is that which is based upon root absorption. Particularizations are given.

The influence of nutrition on the susceptibility of plants to parasitic attack, I [trans. title], E. SCHAFFNIT and A. VOLK (*Forsch. Geb. Pflanzenkrankh. u. Immunität Pflanzenr. No. 3 (1927), pp. 1-45, figs. 9*).—Tests are detailed and results tabulated for a number of economic plants named as tested in relation to different nutrient media when subjected to inoculation with parasitic organisms.

The incubation period of the parasite was very little affected by nutrition, though a relation was established between the nutrient medium and the period from inoculation to formation of the fruiting bodies. In general, that period was longer in case of the plants which were the more resistant to disease. The effects are detailed of substances individually.

Infectious chlorosis [trans. title], W. HEITZSCH (*Ztschr. Bot., 20 (1927), No. 2-3, pp. 65-85, figs. 20*).—The author shows, by numerous examples, not only that infectious chlorosis occurs by infective transmission in the family Malvaceae, but that closely analogous conditions are present or producible in numerous members of widely separated plant families.

Bacteriology and anatomy of crown gall [trans. title], J. MAGBOU (*Rev. Path. Vég. et Ent. Agr., 14 (1927), No. 1, pp. 45-50*).—Observations on large crown gall tumors associated with *Bacterium tumefaciens* in tomato are reported, bearing out the observation that the agent of crown gall acts at a distance to produce its characteristic effects.

Root rot caused by *Pythium* and *Aphanomyces*, A. MEURS (*Wortelrot, Veroorzaakt door Schimmels uit de Geslachten Pythium Pringsheim en Aphanomyces de Bary. Proefschr., Rijks-Univ., Utrecht, 1928, pp. VIII+94+2, figs. 5; Eng. abs., pp. 87, 88*).—This is a Utrecht University thesis.

Biological forms of anther smut [trans. title], V. GOLDSCHMIDT (*Ztschr. Bot., 21 (1928), No. 1-2, pp. 1-90, figs. 3½*).—A study of parasitic specialization is detailed.

Agricultural experiments and results and discoveries of diseases in wheat, F. MADDOX (*Sydney: Shipping Newspapers, Ltd., 1928, pp. 47*).—The author presents an account, including his own experimentation, publication (largely in newspapers), and correspondence (subsequent to 1885 and as late as 1928), regarding his efforts to overcome obstacles to profitable wheat raising, more particularly the improvement of wheats, the effects of various manures, and discoveries made by him during attempts to minimize the losses due to fungus diseases of wheat. The discoveries claimed as original include the flower infection of wheat by loose smut, the transportation by thrips of the spore to the ovary, the simultaneous occurrence on a plant of both bunt and loose smut, and the causation of bunt disease by reinfection of grain after treatment.

Genealogical selection and plant disease control [trans. title], F. MOREAU (*Rev. Path. Vég. et Ent. Agr.*, 14 (1927), No. 1, pp. 27-29).—An account of work accredited to Beauverie states that selection and breeding during 1922-1925 of wheat varieties found to show resistance to yellow rust separated several strains which are indicated as resistant to the organism *Puccinia glumarum* in different degrees (indicated on a scale of 0 to 4).

Cereal rusts and yield [trans. title], V. DUCOMET (*Rev. Path. Vég. et Ent. Agr.*, 14 (1927), No. 4, pp. 247-252).—*Puccinia graminis* and *P. glumarum* were about equal as regards their damaging effect on wheat yield. This loss averaged about 10 per cent.

Wheat rusts in 1925-26 [trans. title], V. DUCOMET (*Rev. Path. Vég. et Ent. Agr.*, 14 (1927), No. 1, pp. 39-44).—An account is given of the appearance and incidence (varietal and anatomical), chiefly of *Puccinia glumarum*, *P. triticea*, and *P. graminis*.

Smut studies preliminary to wheat breeding for resistance to bunt, D. C. TINGEY (*Jour. Amer. Soc. Agron.*, 19 (1927), No. 7, pp. 655-660).—In 1925, 30 per cent of the wheat crop in northern Utah and southern Idaho graded smutty, and in the fall the Utah Experiment Station began extensive experiments seeking strains resistant under local conditions.

In the fall and spring sowing tests about 260 strains were used. The varieties secured from the Bureau of Plant Industry, U. S. D. A., and the Washington Experiment Station gave no infection. Of the local strains tested in the fall, none except Odessa showed any high degree of resistance. Of spring testings, eight strains showed no infection. These exceptions are supposedly due to chance, but these strains are to be subjected to further tests.

With resistant strains omitted, the average percentage of infected plants was 82.3 for fall seedings and 21.3 for spring seedings. Similar material, heavily smutted but treated with copper carbonate, showed infection rates of 1.4 and 0.01 per cent, respectively.

Seed dry disinfection to prevent wheat stinking smut [trans. title], M. BENLLOCH (*Bol. Patol. Veg. y Ent. Agr. [Madrid]*, 2 (1927), No. 5-7, pp. 36-42, figs. 6).—A brief account of apparatus and experience indicates that in the matter of wheat smut (*Tilletia tritici* and *T. laevis*) relatively dry soil and shallow seeding reduce attack percentage, as does also very early or late seeding or moderately high temperature.

Report on celery blight and its prevention, H. H. STIRRUP and J. W. EWAN (*Midland Agr. and Dairy Col. Bul.* 14 (1927), pp. 12, figs. 2).—"This important disease of celery, which is perhaps better named 'leaf spot' in the early stages and 'blight' in the later stages, has been the subject of investigation and experiment in North Lincolnshire for the last three years." This account, intended for large celery growers, market gardeners, and home gardeners, includes symptoms of celery blight, weather conditions favorable to the disease, infected seed, and spraying. Instructions are given for making Bordeaux mixture and Burgundy mixture and the application of the sprays. In spraying demonstrations in 1926, the protective results achieved were excellent and about equal for the two preparations.

Preventive methods for scorch of chickpea [trans. title], J. DEL CAÑIZO (*Bol. Patol. Veg. y Ent. Agr. [Madrid]*, 2 (1927), No. 5-7, pp. 10-13, figs. 3).—Chickpea scorch (*Phyllosticta rabiei*), attacking particularly the stems, and measurably the pods, but not the leaves, causes much loss in Spain each year.

Protective measures, which are exclusively preventive, include the burning of crop residues, disinfection of the seed by steeping for 5 minutes in copper sulfate solution (5 gm. per liter), and spraying with Bordeaux mixture at 2 per cent during growth.

Radiations from *Bacterium tumefaciens* [trans. title], J. and M. MAGROU (*Rev. Path. Vég. et Ent. Agr.*, 14 (1927), No. 4, pp. 244-246).—In view of the fact that *B. tumefaciens* has been supposed to exert its tumor-developing influence at a distance, the authors tested the effects on the roots of an onion growing within a test tube with *B. tumefaciens* in suspension at a distance of a few millimeters. It was found that the mitoses in the part nearer to the suspension were consistently more numerous, showing an average excess of 26 per cent.

Potato disease in Forez [trans. title], C. PERRET (*Rev. Path. Vég. et Ent. Agr.*, 14 (1927), No. 4, pp. 259-266).—The director of the experiment station of Merle (Loire, France) presents figures for April to September, 1927, inclusive, as regards temperature and precipitation in relation to the prevalence, severity, and control of potato diseases.

Dry-rot of swedes and turnips: Its cause and control, G. H. CUNNINGHAM (*New Zeal. Dept. Agr. Bul.* 133 (1927), pp. 51, figs. 30; abridged in *New Zeal. Jour. Agr.*, 35 (1927), No. 1, pp. 1-14, figs. 11).—Since its first recorded appearance (1905) in New Zealand, dry-rot has become the most serious disease locally of swedes, causing losses of from 50 to 100 per cent of the swede crop in seasons favorable to its development, or a somewhat smaller loss in case of the turnip crop.

The causal organism comprises several strain groups, characterized by growth curve, color of mycelium on standard media, sporulation, staling, and staining reaction. Cultures of *Phoma lingam*, *P. napobrassicae*, *P. brassicae*, and *P. oleracea*, obtained from abroad, belong in certain of these strain groups. Morphological comparisons show that pycnidia of these strain groups and pycnidia obtained in cultures of *P. lingam*, *P. napobrassicae*, *P. brassicae*, and *P. oleracea* resemble one another so closely that separation of any one is not possible. Consequently, all these are considered to be synonyms of *P. lingam*, and this name is recognized as entitled to preference. Detailed descriptions and synonymy are given.

P. lingam has been found in New Zealand on the swede, turnip, and cabbage. Hosts recorded elsewhere are noted. A detailed description of the symptoms produced on leaves, stems, pods, and bulbs is given. Development of pycnidia and mechanism of spore discharge are discussed.

The treatment adopted as a result of laboratory experiments is to steep seed for one hour in Semesan (0.25 per cent) solution held at 115° F. This gives complete control without serious injury to seed of high germinability. This satisfactory method has in field practice been vitiated by contamination from cultural implements, etc. It is thought that cooperation and thoroughness would eliminate this disease very quickly.

Diseases of tomatoes, with special reference to leaf spot and downy mildew of onions, G. H. BERKELEY (*Ontario Veg. Growers' Assoc. Ann. Rpt.*, 23 (1927), pp. 13-20, fig. 1).—This brief account claims that tomato leaf spot requires for control sanitary measures, including the thorough turning under of all refuse and spraying or dusting with Bordeaux mixture if the disease appears. Mildew (leaf mold), the severity and difficulty in the control of which depend largely upon weather conditions, requires good ventilation (drying air circulation, using extra heat if needed). Bordeaux mixture, if applied, should be put on copiously and under great pressure.

Late blight of tomato, D. G. MILBRATH (*Calif. Dept. Agr. Mo. Bul.*, 17 (1928), No. 4, pp. 271-274).—Tomato late blight is described as due to *Phytophthora infestans* and as causing heavy losses during two years in California. The causal organism is discussed as regards its relation to the fruit and to the soil, also as to its control, for the purpose of which sprays appear to be prefer-

able to dusts. Cost estimates and directions are given as regards the making of Bordeaux mixture in stock solutions, regarded as the handier method.

Some diseases of the pear, D. G. MILBRATH and C. E. SCOTT (*Calif. Dept. Agr. Mo. Bul.*, 16 (1927), No. 8, pp. 445-452, figs. 6).—Brief discussions of local disease conditions as regards pear included scab (*Venturia pyrina*), black end (no organism yet found), and so-called stigmonose and internal brown spot, this last resembling bitter pit and relating to the fruits of Buerre d'Anjou pears.

An investigation of the causes of mouldiness of cured cacao, T. LAYCOCK (*Nigeria Agr. Dept. Ann. Bul.*, 7 (1928), pp. 5-16, pls. 4).—The fungi isolated during this work were principally *Aspergillus* spp. It is claimed that under humid conditions fermented cacao beans mold much more readily than unfermented. They are also much more permeable to moisture, the husk being the part principally concerned in reabsorption. This greater proneness to moldiness is not due solely to higher permeability for moisture or to the presence of moisture arising during the process of curing. The H-ion concentration of extracts from both types of beans supposedly relates to the degree of moldiness. Acidification of fermented husk extract inhibits mold development, while alkalinization of unfermented husk extract increases fungus growth. The difference in the chemical composition of the two kinds of husk is thought to determine in part the conditions of subsequent molding.

Thorough grading in the field of cacao is suggested by the facts that the presence of unripe or diseased beans favors mold increase, discoloration and inferiority, and (presumably) molding during later storage. Fermentation should be carried out in large boxes in open sheds protected against rain. Good drying during the initial stage is important. Storage should be as brief as possible.

A dahlia leaf spot due to *Aphelenchus ritzema-bosi*, I [trans. title], H. WEBER (*Forsch. Geb. Pflanzenkrankh. u. Immunität Pflanzenr.* No. 3 (1927), pp. 129-137, pl. 1, figs. 2).—In recent years, particularly in the wet spring of 1926, the chrysanthemum leaf spot due to the nematode *A. ritzema-bosi* has been common in horticultural gardens in the Rhine Province. Brief details are given of this trouble and of the incidence of forms supposed to be morphologically identical on dahlia and on chrysanthemum. Both development and movement of the nematode are favored by conditions in the hothouse. It is advisable to reduce humidity as much as is possible.

Douglas fir leaf-cast disease (*Rhabdocline pseudotsugae* Syd.) ([*Gt. Brit.*] *Forestry Comn. Leaflet* 18 (1927), pp. 3, pl. 1).—Douglas fir, previously remarkably free from leaf disease in Great Britain, has for the last few years been attacked as regards the blue form (*Pseudotsuga glauca*), the interior dry belt or Fraser River form (*P. douglasii caesia*), and (more recently) the green Douglas fir (*P. douglasii*) by the leaf cast fungus, *R. pseudotsugae*, previously common in the United States. This brief account includes a description, the life history, injury caused, and control methods (limited to removal of affected trees when these are few in number, or in case of nursery stock to spraying with Bordeaux mixture containing soap while the fructifications are opening).

Larch canker ([*Gt. Brit.*] *Forestry Comn. Leaflet* 16 (1927), pp. 4, figs. 3).—Larch canker (*Dasyctypha calycina*) is said to be present in nearly every plantation of larch (*Larix europaea*) in Great Britain. Japanese larch (*L. leptolepis*) is seldom attacked, but western American larch (*L. occidentalis*) appears less resistant than the European species.

The manner and effects of the attack are described. Young trees may be girdled and killed. Older trees usually survive, showing no check as to growth, but undergoing some depreciation as to the value of the timber.

The spores, which are borne in the concave part of the fructification, are ejected when mature and are carried by wind to other trees, gaining admission to cause infection only through stumps of dead branches or through wounds. The mycelium, which lives saprophytically on the dead parts, may extend its growth into the main stem, becoming parasitic on the living tissue. Wounds made by rodents or during planting operations are usually soon protected by the resin flow. Pruning seldom or never gives rise to infection.

Good planting and living conditions are indicated as important. Immune and soil-improving associates should be planted, as beech. Promotion of vigor in the larch is emphasized.

White pine blister rust (*Calif. Dept. Agr. Mo. Bul.*, 16 (1927), No. 12, pp. 676, 677).—In a brief statement compiled by G. A. Root, Bureau of Plant Industry, U. S. D. A., it is stated that the counties of Marin, Sacramento, San Joaquin, Contra Costa, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Inyo were cleared of cultivated black currants during the season, this number making a total of 41 counties in California cleared since the eradication work was started in 1924. The eradication of wild currant and gooseberry bushes in certain sugar pine areas in the Stanislaus National Forest was completed over 3,536 acres at a cost of about \$2 per acre. This method, though still experimental, appears to afford practical protection. Spraying with chemicals promises to be cheaper and more effective than hand pulling where the bushes grow in profusion. From a portable fire pump, of a locally familiar type, has been developed a light portable power sprayer which can be carried easily on a horse or, if necessary, by a man.

The biology of *Polyporus gilvus* (Schw.) Fries, R. R. Hirt (*N. Y. State Col. Forestry, Syracuse Univ., Tech. Pub.* 22 (1928), pp. 47, pls. 11, figs. 2).—In the conclusion of this account of *P. gilvus*, the respective sections of which deal with distribution and host woods, history and synonymy, the sporophore, culture studies, wood destruction, and parasitism, it is stated that this fungus, because of its wide distribution and its ability to attack a great variety of woods, destroys large quantities of wood every year. Found commonly on living trees, it acts mainly as a saprophyte, attacking the living tissues, it is supposed, only when these are not normally healthy. Only two coniferous hosts are indicated.

P. gilvus is found on living hosts only when these have been injured by lightning, fire, frost, or mechanical means, exposing dead sapwood. Though the attack on living wood is not serious, the heartwood attack may spoil that part commercially and may impair or destroy infected structural timbers. In the forest it is economically important in reducing slash to a form available for other plants.

P. gilvus has been grown throughout its cycle in culture and shown to produce no secondary spores. In agar cultures basidia have been produced, bearing five spores on as many sterigmata. Sporulation, though periodic as to spore numbers produced, is continuous over periods of various lengths. The fungus is homothallic. Single spore cultures on wood blocks produced therein extreme decay, corresponding to that produced under natural conditions, and proving the causal agency of *P. gilvus* in the associated white decay.

A method of producing young sporophores and fresh spores at any season of the year is described, and the same method is said to have been used successfully with *Trametes suavis*, suggesting the possibility of germination studies from fresh spores at the convenience of the investigator. The growth of the commonly stratified sporophores has been studied, but they do not indicate perennial growth. The new growth is produced from the mycelium within

the wood at the base of the sporophore, and not from any live mycelium within the context or tube layer of the previous year's fruiting body.

Chemical changes in the wood decay were tested with common microchemical stains, and these tests were verified by a chemical analysis of the decayed and normal wood. The change is found to consist mainly in the destruction of the cellulose structures of the cell walls. Delignification occurs only in those elements where lignin appears to be present in small quantities. The highly lignified elements remain in the most extreme decay with no apparent breakdown of the walls, except for the large number of perforations through which the hyphae passed. The apparent bleaching in the decayed wood indicates some chemical change. Hyphae were found to be present in all stages of decay, appearing more abundantly in the final stages, in which they were massed within the larger vessels.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Hibernation of the thirteen-lined ground squirrel, *Citellus tridecemlineatus* (Mitchell), I, II, G. E. JOHNSON (*Jour. Expt. Zool.*, 50 (1928), No. 1, pp. 15-30, fig. 1; *Amer. Nat.*, 63 (1929), No. 685, pp. 171-180, figs. 3).—The first part of this contribution from the Kansas Experiment Station deals with a comparison of the normal and hibernating states and the second part with the general process of waking from hibernation.

Trapping moles, J. J. WOODS (*Canada Dept. Agr. Circ.* 67 (1928), pp. 3, figs. 2).—A brief practical account.

The winter food of the eastern skunk, W. J. HAMILTON, JR. (*Amer. Fur Breeder*, 2 (1929), No. 1, p. 4, fig. 1).—Examinations made by the author of over 100 stomachs of the eastern skunk taken by trapping in central New York from December 22 to February 4 led to the discovery that over 90 per cent were infested with roundworms. The food was found to consist of mammals, insects, grasses, garbage, birds, inorganic matter, amphibians, earthworms, and small crustaceans. The mammals, which composed 31.1 per cent of the food, included wood mice (*Peromyscus*), meadow mice (*Microtus*), the star-nosed mole (*Condylura*), the cottontail, the flying squirrel, and the short-tailed shrew. Plant food represented 20.4 per cent. The insects, which represented 15.9 per cent, consisted largely of grasshoppers. The inorganic food represented 13.8 per cent of the total food.

Exploring the wonders of the insect world, W. J. SHOWALTER (*Natl. Geogr. Mag.*, 56 (1929), No. 1, pp. 1-90, pls. 24, figs. 59).—This is a popular account, accompanied by numerous illustrations, including 24 colored plates of numerous species of Orthoptera, Hemiptera, Odonata, Hymenoptera, Diptera, Microlepidoptera, and Coleoptera.

Respiration in the insects, M. O. LEE (*Quart. Rev. Biol.*, 4 (1929), No. 2, pp. 213-232).—This discussion is accompanied by a list of 57 references to the literature.

On the effect of random oviposition on the action of entomophagous parasites as agents of natural control, W. R. THOMPSON (*Parasitology*, 21 (1929), No. 1-2, pp. 180-188).—This is a contribution from the Imperial Bureau of Entomology.

Sulfonated oxidation products of petroleum as insecticide activators, M. T. INMAN, JR. (*Indus. and Engin. Chem.*, 21 (1929), No. 6, pp. 542, 543).—This is a brief report of a study made of the application of the oxidation products of petroleum to insecticidal use conducted during the past four years in cooperation with State entomologists and the Crop Protection Institute. This

has resulted in the development of a definite procedure in attacking soft-bodied sucking insects, such as aphids and leafhoppers.

By the addition of chemically treated oxidation products of Pennsylvania gas oil to a solution of nicotine sulfate, the efficiency of the poison was strikingly increased. Where these oxidation products were added at the rate of 1 to 200 to nicotine sulfate spraying solutions, a satisfactory kill was obtained with only one-third to one-fifth of the nicotine commonly employed when soap is used as a spreader. The underlying principle is, briefly, the increase of the efficiency, or the activation, of an insecticide by bringing about certain physical changes in the resultant spray mixture. This group of chemically treated oxidation products of Pennsylvania gas oil has been termed an "activator" in explanation of its performance in the insecticide field.

The use of carbon dioxide to increase the insecticidal efficacy of fumigants, R. T. COTTON and H. D. YOUNG (*Ent. Soc. Wash. Proc.*, 31 (1929), No. 5, pp. 97-102).—The authors find that carbon dioxide in admixture with the vapors of ethylene dichloride, methyl chloroacetate, carbon disulfide, chloropicrin, and ethylene oxide appears to be of considerable value for fumigation purposes. It accelerates the toxic action upon insects of these vapors to such an extent that the dosage and length of exposure may be greatly reduced. It is noninjurious to man and to the merchandise fumigated, and has the added advantage of removing or reducing the fire hazard of inflammable fumigants.

Annual report of the department of zoology and entomology, R. W. HARNED (*Mississippi Sta. Rpt. 1928*, pp. 23-29).—This is a progress report of work conducted in continuation of that previously noted (*E. S. R.*, 62, p. 53), presented under the headings of scale insects, pecan insect, cotton aphid, and crawfish projects. Work with scale insects, continued by G. Hoke, led to the addition of approximately 30 species to the State list, including several undescribed forms.

The pecan insect work is reported upon by J. M. Langston, who found the pecan weevil to infest 6.08 per cent with 40 larvae from 773 nuts. Three adults of the twig girdler were reared in September, 1927, from two twigs girdled in September, 1926. Work with the flat-headed borer was somewhat reduced due to lack of infested trees. Life history studies of the walnut caterpillar were conducted at Ocean Springs by J. P. Kislanko. The percentage of parasitism increased from 10.82 of the eggs parasitized in the first generation to 69.06 in the second generation and 92.26 in the third generation. Reference is made to the bulletin on the Phyllophaga of the State by Langston (*E. S. R.*, 60, p. 166), 30 different species of the May beetle having been found feeding upon the foliage of the pecan.

Work with the cotton aphid was conducted by A. L. Hamner, an account of the prediction of aphid outbreaks by whom has been noted (*E. S. R.*, 60, p. 455). In generation studies, data are given on the first born, last born, and increase of infestation. In control work both the 5 and 7.5 per cent nicotine sulfate dusts gave good results, 0.2 lb. of available free nicotine per acre being found to be the most economical rate of application. *Lamium amplexicaule*, one of its two winter hosts, the other being *Rumex crispus*, was found to survive and carry the aphids over.

The study of the crawfish was continued by R. N. Lobdell, who reports upon this pest in its relation to Mississippi levees. It was found that a burrow made by this animal entirely within "buckshot" soil was harmless, but if it penetrated a stratum of sand or sandy loam it was potentially dangerous to the safety of the levee even when several hundred feet from its toe.

In considering miscellaneous work, reference is made to studies of the ants in the State by M. R. Smith, who during the year increased the State record from 87 to 107 species and varieties.

Report of the division of entomology, [F. SEIN, JR.] (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt. 1928, Eng. ed., pp. 89-98*).—This is a report of the activities of the division prepared by the assistant entomologist. Particular attention is given to the root caterpillar of sugarcane, a pyralid found to represent a new genus and species, for which the name *Perforadix sacchari* is proposed. This caterpillar bores into the roots of sugarcane, and has also been found to puncture the roots of two species of bamboo growing near cane fields to an even greater extent than the roots of sugarcane. A thysanuran, thought to represent a new genus, also injured sugarcane and is being studied with a view to determining its importance. Nymphs of the gray fulgorid *Oliarus cinereus* Wolcott were also found feeding on the roots. These studies of root-infesting insects were made in search of other possible transmitters of cane mosaic than the corn leaf aphid, the only insect feeding upon the cane plant above ground that is known to transmit the virus. The yellow aphid (*Sipha flava* Forbes), which lives throughout its entire life on the mature leaves without ever feeding on the tender unfurled leaves like the corn aphid, has been proved by the station to be incapable of transmitting mosaic.

Reference is made to a simple method of inoculating cane with the virus by pricking the mosaic tissues and the healthy plant in imitation of the corn aphid. By pressing unfurled mosaic leaves close to unfurled healthy leaves and running the pin through the mosaic into the healthy, 25 infections were obtained from the 38 plants inoculated. Whether the virus is present in the roots has not as yet been definitely determined, although experiments similarly conducted have given negative results. Experiments thus far conducted led to the conclusion that the root caterpillar can not be considered a vector of mosaic disease.

Work with the West Indian fruit fly has shown it to be incapable of breeding in grapefruit in Porto Rico. In experiments conducted in which 200 fruit flies were placed in cages with ripening grapefruit they apparently oviposited in the fruit, but no development took place therein. That the artificial conditions supplied inside the cage were not responsible for failure to breed in the grapefruit is considered to be shown by the fact that guava fruits of the "pera" variety became infested. At the same time the guava fruits of a native variety which are practically immune remained sound within the cage. While in Argentina this fruit fly has been reported to destroy 50 per cent of the orange crop, in Porto Rico it has never been found in any citrus fruit. A comparison of the Porto Rican and Argentine forms has led the author to conclude that the difference in size and habits justifies the establishment of a new variety for the Porto Rican form.

The banana root borer, which continued its spread over the island, was studied, an acre having been planted with bananas from seed from badly infested plantations with a view to determining if it would be possible to obtain a sound plantation from badly infested seed properly cleaned. The result of the work has shown it to be a difficult task to examine each and every one of the corms in order that all infested seed may be eliminated. It is concluded that while there are no immune varieties of bananas a new crop can be obtained by setting out clean seed in clean soil, but where a 100 per cent clean plantation can not be obtained the pest can be controlled by the approved methods of roguing out the infested plants, destruction of infested material, and trapping of the adults.

Ipbobracon granadensis Ashm., the parasite of the sugarcane borer imported from Venezuela, has failed to become established or occurs in such small numbers as to have been overlooked.

[Contributions on economic insects] (*Bol. Lab. Zool. Gen. e Agr. R. Ist. Super. Agr. Portici*, 21 (1928), pp. 130-214, 218-301, figs. 79).—The articles here presented relating to insects of economic importance include the following: The Violet Midge in Southern Italy (*Dasyneura affinis* Kieff), by C. Colizza (pp. 130-148); Contribution to the Knowledge of the Mediterranean Flour Moth and Its Parasite *Nemeritis canescens* Gravenhorst, by G. S. Candura (pp. 149-214); Studies of the Psyllidae.—I, Contribution to the Knowledge of the Fig Psyllid (*Homotoma ficus* L.) (pp. 218-251), and II, Description of a New Species of Psoroccephala from China and of Its Larval Stages (pp. 251-264), by F. B. Boselli; The Almond Anthonomus *A. ornatus* Reiche in the Province of Matera, by R. Sarra (pp. 265-274); and a Contribution to the Knowledge of *Gryllotalpa gryllotalpa* L., by V. Conte (pp. 275-301).

A method for rearing mushroom insects and mites, C. A. THOMAS (*Ent. News*, 40 (1929), No. 7, pp. 222-225).—The author describes a method found to be more satisfactory than any hitherto described.

Pests and diseases of Queensland fruits and vegetables, R. VEITCH and J. H. SIMMONDS (*Brisbane: Queensland Dept. Agr. and Stock*, 1929, pp. 198, pls. 64).—Chapter 1 of this work consists of an account of insects and their relatives, chapter 2 insect anatomy, chapter 3 insecticides, chapter 4 fungi and bacteria, chapter 5 classification of fungi, and chapter 6 fungicides and disease control. Chapters 7 to 12 include accounts of insect pests and diseases of deciduous fruits, citrus, bananas, pineapples, tomatoes, and vegetables, respectively. General insect feeders, nematodes, etc., are considered in chapter 13. Directions for entomological and pathological inquiries are given in chapter 14.

A manual of external parasites, H. E. EWING (*Springfield, Ill.: Charles C. Thomas*, 1929, pp. XIV+225, figs. 96).—This manual has been prepared in an attempt to give a background for the study of the different groups of ectoparasites. Keys in most cases have been given to the known genera of the world, and in addition supplementary taxonomic matter has been added together with some consideration of the external anatomy, life histories, natural relationships, and economy. Chapter 1 of the work deals with the parasitic mites (pp. 1-64); chapter 2 with the Ixodoidea, or ticks (pp. 65-89); chapter 3 with the Mallophaga, or biting lice (pp. 90-126); chapter 4 with the Anoplura, or sucking lice (pp. 127-152), and chapter 5 with the Siphonaptera, or fleas (pp. 153-183). Chapter 6 (pp. 184-203) is an appendix in which descriptions are given of new genera of ectoparasites. References to the literature are given at the close of each of the first five chapters.

On the larval migration of some parasitic nematodes in the body of the host and its biological significance, F. FÜLLEBORN (*Jour. Helminthol.*, 7 (1929), No. 1, pp. 15-26, pl. 1, figs. 2).—This is a lecture delivered at the London School of Hygiene and Tropical Medicine in March, 1929. The account, which includes work conducted by the author, is presented in connection with a list of 42 references to the literature.

Habits and control of termites, A. E. MILLER (*Ill. Nat. Hist. Survey, Ent. Ser. Circ.* 11 (1928), pp. 12, figs. 7).—This is a revision of a circular previously noted (*E. S. R.*, 57, p. 163).

The Mormon cricket and its control, F. T. COWAN and S. C. McCAMPBELL (*Colo. State Ent. Circ.* 53 (1929), pp. 28, figs. 11).—The authors report that calcium arsenite dust, mixed at the rate of 1 part to 3 parts of hydrated lime and dusted on the cricket bands at the rate of 8 lbs. of the mixture per acre, is a reliable means of control for the Mormon cricket. Not only does it kill

great numbers of the insect, but it also serves as a protection for crops in cricket-infested territory.

Some notes on the grasshopper situation in north central Montana, R. L. SHORWELL (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 581-588).—The author here discusses briefly the grasshopper situation up to and including 1926 in the part of Montana known as the Triangle. Observations were made of weather conditions surrounding a threatened local outbreak in 1926, the results of which indicate the intimate relationship between physical factors and grasshopper abundance and emphasize their importance in grasshopper control.

The biology of Thysanoptera with reference to the cotton plant.—IV, The relation between the degree of infestation and surface caking of the soil, E. I. MACGILL (*Ann. Appl. Biol.*, 16 (1929), No. 2, pp. 288-293, figs. 2).—This fourth contribution on the biology of Thysanoptera (E. S. R., 58, p. 453) deals with the relations of infestation to surface caking of the soil. The "results of experiments on the effect of water supply on the infestation of a plant by thrips suggested that the surface caking of the soil has an important influence on the degree of infestation. Plants grown in pots in which the surface of the soil was tilled showed a higher infestation by thrips than plants in similar pots but in which the soil was allowed to cake, although both sets of plants were receiving an equal water supply and all other conditions were the same. The difference in the infestation factors for the two groups was largely due to differences in the numbers of larval thrips, but it is pointed out that the number of larvae forms a more reliable factor than the number of adult insects. The present experiments support the suggestion put forward that surface caking of the soil acts inimically to soil-pupating species of thrips."

A membracid enemy of fruit and other plants, *Aethalion reticulatum* (L.) [trans. title], L. A. DE AZEVEDO MARQUES (*Min. Agr., Indus. e Com., Inst. Biol. Defesa Agr. [Brazil] Bol.* 6 (1928), pp. 27, pls. 4).—This is a summary of information on the morphology and biology of a membracid enemy of citrus, mangoes, etc., in Brazil, where it sucks the sap of shoots, causing them to die. Under the name *Abbelloides marquesi* Bréthes n. g. and sp., a new parasite of the pest is described by J. Bréthes.

A parasite of the woolly apple aphid, the *Aphelinus mali* [trans. title], H. FAES (*Ann. Agr. Suisse*, 29 (1928), No. 5, pp. 515-519, figs. 2).—A brief summary of information on the parasite *A. mali* and its introduction into and establishment in Switzerland, in which country there are 6 or 7 generations a year.

A new juniper aphid from Utah, with notes on a few other species, I, II, G. F. KNOWLTON (*Fla. Ent.*, 12 (1928), No. 4, pp. 59-62, fig. 1; 13 (1929), No. 1, pp. 4-8, figs. 3).—Under the name *Minuticornicus gravidis* n. g. and sp., the author describes a small green aphid which attacks the red cedar, apparently feeding on the scalelike needles of the smaller twigs.

A contribution to the knowledge of the Aleurodidae living on Citrus in the Far East and of their parasites [trans. title], F. SILVESTRI (*Bol. Lab. Zool. Gen. e Agr. R. Ist. Super. Agr. Portici*, 21 (1928), pp. 1-60, figs. 34).—The first part (pp. 1-19) of this account consists of descriptions of 11 forms, of which 2 are described as new. The second part (pp. 20-59) consists of descriptions of 20 chalcid parasites found attacking the Aleurodidae, of which 15 represent new forms.

The use of chloropicrin against coccid enemies of the orange and date [trans. title], A. PIÉDALLU and A. BALACHOWSKY (*Compt. Rend. Acad. Sci. [Paris]*, 187 (1928), No. 16, pp. 671-673; also in *Bul. Agr. Algérie, Tunisie, Maroc*, 2, ser., 34 (1928), No. 10, pp. 181-183; abs. in *Rev. Appl. Ent.*, 17 (1929),

Ser. A, Nos. 1, p. 19; 2, p. 101).—The authors have obtained successful results in tent fumigation with chloropicrin against coccid enemies of the orange and date in Algeria. In order to insure good results, the evaporation of the liquid must take place within one hour, and the inclosed atmosphere must be saturated uniformly. Since the fumes are heavy and tend to descend, it is best to heat the air under the cover with an oil or spirit lamp or by electricity. With an exposure of 45 minutes, 100 per cent mortality was obtained with 20 gm. of chloropicrin per cubic meter (1.5 oz. to 70 cu. ft.) in the case of Florida red scale on orange and *Aspidiotus lataniae* Sign., *Diaspis zamiae* Morg., and long-tailed mealybug on *Strelitzia augusta*, and with from 15 to 20 gm. in that of *Parlatoria blanchardi* Targ. on date palms. The orange trees and date palms should be fumigated after harvest and before flowering, since chloropicrin vapor is liable to scorch young shoots and flowers.

Combating the apple and cherry ermine moth [trans. title], H. FAES (Ann. Agr. Suisse, 29 (1926), No. 5, pp. 520-533, figs. 11).—An account is given of work with the ermine moth attacking the apple as observed at Lausanne from 1926 to 1928. Studies of this pest by Parrott and Schoene in New York have been noted (E. S. R., 28, p. 557).

Attraction of the rice borer moth to lights at different periods, T. KASURAKI and A. KAMITO (Jour. Col. Agr., Imp. Univ. Tokyo, 10 (1929), No. 2, pp. 151-158, fig. 1).—Investigations of the attraction of moths to lights of various intensities in light traps have led the authors to recommend this as one of the most effective means of combating *Chilo simplex*, a very destructive enemy of the rice plant. It was found that light exercises a greater attraction to the moths before than after midnight. The females are more strongly attracted to light before midnight than are the males, but after midnight the reverse is true. A high rate of attraction to the light is shown by the females one or two hours after sunset, and by the males one or two hours still later. The attraction to the light reaches a high rate in the females at about the time mating and egg laying begin, and in the males at about the time that mating is accomplished. The moths, when in a certain physiological state, are generally attracted to the light at a high rate; this attraction appears to be of a secondary but not of a primary character.

The codling moth as a pest of stone fruits, R. H. SMITH (Calif. Dept. Agr. Mo. Bul., 18 (1929), No. 5, pp. 304-309, figs. 2; also in Calif. Cult., 73 (1929), No. 2, p. 29).—The author here reports cases which showed the codling moth to infest plums, peaches, and apricots in California, and indicate that it is maintaining itself on stone fruits independent of other hosts.

Some parasites of the oriental peach moth in New Jersey, B. F. DRIGGERS (Jour. N. Y. Ent. Soc., 37 (1929), No. 2, pp. 169, 170).—This is a contribution from the New Jersey Experiment Stations, in which the author presents a list of the parasites obtained from peach moth pupae, summer larvae, and hibernacula collected from different localities in New Jersey in 1927 and 1928. This list supplements that of Stearns (E. S. R., 60, p. 62).

Notes on paradichlorobenzene and naphthalene as repellents against clothes moth larvae, L. J. BORTIMER (Jour. Econ. Ent., 22 (1929), No. 3, pp. 570-573).—Paradichlorobenzene and naphthalene, used in small quantities in a room of average size, were of no practical value as repellents against larvae of the webbing clothes moth. In tests with each of these insecticides, more than one-half of the larvae concerned remained for two days within 6 in. of the material and were apparently uninjured.

Typical flies: A photographic atlas, E. K. PEARCE (Cambridge, Eng.: Univ. Press, 1921, 2. ser., pp. XIV+38, figs. 125; 1928, 3. ser., pp. XIV+[I]+64, figs. 162).—A second and a third series of the plates (E. S. R., 34, p. 654) of photo-

graphic reproductions of Diptera follow an outline of Brauer's Classification of Diptera.

The significance of the pH in the development of mosquito larvae, M. E. MACGREGOR (*Parasitology*, 21 (1929), No. 1-2, pp. 132-157, fig. 1).—It is shown that the influence of the pH is of unquestionable importance, since under natural conditions it indicates the favorable or unfavorable association of chemical and biological factors in the breeding places upon which the successful development of the larvae depends.

Twenty-five years' study of control work with malaria in Algeria [trans. title], E. and E. SERGENT (*Arch. Inst. Pasteur Algérie*, 6 (1928), No. 2-3, pp. [7]+117-434, figs. 148).—This includes a detailed account of studies of control work with anophelines.

Cephenomyia sp. killing deer, C. R. WALKER (*Science*, 69 (1929), No. 1799, pp. 646, 647).—A brief account is given of the death of black-tailed deer below Gunnison, Colo., as caused by the larval stage of *Cephenomyia* sp. Upon autopsy, clusters of the larvae were found in such masses as almost to stop completely the nasal passage, 54 larvae having been taken from one animal.

A report on measures to prevent introduction of Mediterranean fruit fly, G. H. HECKE (*Calif. Dept. Agr. Mo. Bul.*, 18 (1929), No. 5, pp. 300-303, figs. 3).—This is a brief account of work under way.

[The Mediterranean fruit fly and its control in Florida] (*Citrus Indus.*, 10 (1929), No. 6, pp. 3, 4, 5, 9, 11, 24, 25).—Several accounts relating to control work with this pest are here given, including Tracking the Fly, by A. M. Duke (pp. 3, 4, 24, 25); Refrigeration of Infested Fruit Not an Adequate Safeguard against Spread of Fruit Flies, by C. L. Marlatt (pp. 5, 25); Statewide Body Formed in Fly War (p. 9); and The Fruit Fly Situation, an editorial (p. 11).

It is pointed out in the article by Duke that in addition to citrus the fly is reported to have been discovered in Florida in peaches, guavas, Surinam cherries, eugenia, Barbados cherry, and white sapota. As regards the effect of refrigeration, it is stated by Marlatt that refrigeration even for a period of 6 weeks at a temperature of about 34° F. does not furnish a safe basis for shipment of infested fruit, as has been demonstrated by tests.

A brief summary of fruit fly surveys in Argentina, Spain, and the Canary Islands, M. KISLUK, JR. (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 478-482).—In the course of fruit fly surveys made in 1927 the West Indian fruit fly was found in Argentina in fruits grown in the north and north-western Provinces, and the Mediterranean fruit fly was taken in the Province of La Rioja and is said to be recorded as having been found in the Province of Buenos Aires. In southern Spain grapes were found infested with the Mediterranean fruit fly in 1927, but tomatoes were not so attacked either in Spain or in the Canary Islands.

Hibernation of *Lucilia sericata* Mg., W. M. DAVIES (*Nature [London]*, 123 (1929), No. 3107, pp. 759, 760).—The observations reported indicate that in North Wales *L. sericata* normally hibernates in the larval stage.

Wholesale destruction of *Actinophora fragrans* trees on Java by a buprestid borer [trans. title], L. G. E. KALSHOVEN (*Tectona (Boschbouwk. Tijdschr.)*, 22 (1929), No. 1, pp. 1-22, pls. 8; *Eng. abs.*, pp. 21, 22; also *Dept. Landb., Nijv. en Handel Nederland. Indië, Korte Meded. Inst. Plantenziekten*, No. 10 (1929), pp. 22, pls. 8; *Eng. abs.*, pp. 21, 22).—This is a preliminary account of a small flat-headed borer, which has been killing large numbers of *A. fragrans* trees in the forests of Java.

Soil treatment for control of the Japanese beetle, E. N. COXY and P. D. SANDERS (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 556-561).—The authors report that soil treatment with carbon disulfide emulsion has been the principal

method of fighting Japanese beetle spread in Maryland up to the present time. A total of 3,851,489 sq. ft. in six towns and Baltimore city was treated at an average cost of \$194.79 per acre.

Trapping Calosoma beetles, C. W. COLLINS and J. E. R. HOLBROOK (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 562-569, figs. 2).—The authors have developed a trap for determining the density of the population of *C. sycophanta* L. and incidentally of other tree-climbing beetles. The possibilities of its use in collecting *C. sycophanta* beetles on a large scale for colonization are discussed.

Precipitation and irrigation as factors in the distribution of the Mexican bean beetle, *Epilachna corrupta* Muls., H. L. SWEETMAN (*Ecology*, 10 (1929), No. 2, pp. 228-244, figs. 17).—This is a report of studies conducted at the Wyoming Experiment Station of moisture as an ecological factor in the life of the Mexican bean beetle in irrigated as compared with nonirrigated regions. The account includes a list of 25 references to the literature cited.

Weather a factor in outbreaks of the hickory bark beetle, R. A. ST. GEORGE (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 573-580, figs. 2).—The data presented indicate that weather has a marked effect on the hickory bark beetle, an outbreak of which occurred during the drought period of 1925 in North Carolina. The marked deficiency in precipitation weakened hickory trees by checking growth and rendered them attractive to beetle attacks, favoring brood development. An excess of precipitation during periods of beetle flight resulted in a partial mortality of the adults, thereby considerably reducing the number attacking, and also rendered the trees unfavorable for brood development.

The present status of the sweet potato weevil in the United States, R. W. HARNED (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 502-507).—A discussion of the status of this pest in the five States known to be infested.

The subterranean clover weevil (*Listroderes praemorsa*), L. J. NEWMAN (*Jour. Dept. Agr. West. Aust.*, 2. ser., 6 (1929), No. 1, pp. 29-36, figs. 6).—A report of studies of a curculionid found destroying subterranean clover (*Trifolium subterraneum*).

The alfalfa weevil in alfalfa meal, W. H. LARRIMER and G. I. REEVES (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 491-495, figs. 2).—Studies of the spread of the alfalfa weevil through the medium of alfalfa hay and meal extending over a period of 13 months led to the conclusion that the large number of weevils present in the growing crop diminishes with each step in the handling of the hay, so that the accumulation on the premises of an alfalfa meal mill, even at the end of the summer, is negligible, and the only source of contamination in the mills is the hay which is being ground.

In certain mills whose product was accepted by quarantine officers for interstate shipment it was possible for weevils to pass through the machine alive, but this condition was easily remedied so that meal could be delivered uninfested at the door of the freight car. Cars which have been used for infested alfalfa hay, however, remain infested for an indefinite time thereafter and are used more frequently for other commodities than for alfalfa meal. These cars move rapidly and in large numbers into every part of the United States, and it is they and not the alfalfa meal which constitute the real danger.

Observations on the birch leaf mining sawfly, H. B. PETERSON (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 588-594).—The author summarizes the facts known about a rather unusual type of forest insect pest, *Phyllotoma nemorata* Fallén, which threatens to destroy the white birch in New England. This insect is of foreign origin and has spread at an alarming rate from Nova Scotia westward across New Brunswick and Maine into New Hampshire. Although the mining of the leaves occurs late in the summer, the injury practically stops the growth of the trees the following summer.

Studies on the rush saw-fly, *Tomostethus juncivorus* Rohwer, C. HARUKAWA (*Ber. Ōhara Inst. Landw. Forsch.*, 2 (1925), No. 5, pp. 521-545, pls. 2).—This is a report of studies of the biology of and control measures for the sawfly enemy of the cultivated rush *Juncus effusus decipiens*. Capture of the adults in the nursery, treatment of cocoons, and rotation of crops are important measures for preventing the outbreak of the insect. Tuba fluid, arsenate of lead, the mixture of pyrethrum and wood ash, and an emulsion made from the kerosene extract of pyrethrum are effective as larvicides.

Further notes on the rush saw-fly, *Tomostethus juncivorus* Rohwer, C. HARUKAWA (*Ber. Ōhara Inst. Landw. Forsch.*, 4 (1929), No. 1, pp. 95-101).—In studies conducted in continuation of those above noted, the author has not as yet been able to determine whether the form of this sawfly occurring in Hyogo Prefecture represents a race biologically different from that found in Okayama Prefecture.

On a chalcidoid parasite bred from a flea larva, J. WATERSTON (*Parasitology*, 21 (1929), No. 1-2, pp. 103-106, fig. 1).—Under the name *Bairamlia fuscipes* n. g. and sp., the author describes a chalcidoid parasite reared from cocoons of *Ceratophyllus wickhami* Baker, taken from an American gray squirrel's nest at Gerrard's Cross, Bucks, England.

Populations of ant mounds, E. A. ANDREWS (*Quart. Rev. Biol.*, 4 (1929), No. 2, pp. 248-257).—This is a review of the literature in connection with a list of 15 references and a report of personal investigations. An ant census taken by the author of *Formica exsectoides* in Maryland led to the conclusion that 10,000 adult ants is a conservative estimate of the population in the average mound.

Forty-ninth annual report of the Beekeepers' Association of the Province of Ontario, 1928 (*Ontario Dept. Agr., Beekeepers' Assoc. Ann. Rpt.*, 49 (1928), pp. 88).—The reports and addresses presented at the annual meeting of the association are included.

Success in the artificial insemination of queen bees at the Bee Culture Laboratory, W. J. NOLAN (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 544-551).—The author reports that the Watson method for the artificial insemination of queen bees (*E. S. R.*, 58, p. 165) has been used successfully at the U. S. D. A. Bee Culture Laboratory in 1927 and 1928.

The effects of moving bees at orchard blooming time, R. HUTSON (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 522-526).—In this contribution from the New Jersey Experiment Stations data are presented which indicate that the movement of bees into and out of orchards is attended by an appreciable loss of young brood and queens. It is pointed out that these losses have an effect upon the later performance of the colony as measured by honey production.

The respiratory exchange of the honey bee, G. H. VANSSELL (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 517, 518).—The author finds the average hourly discharge from the hive of water and carbon dioxide during winter to be 1.3 and 17.6 mg., respectively. During the summer, when nectar was coming in, the amounts were 30.8 and 25.2 m.m. per hour.

A study of the factors influencing the yield of honey during the main nectar flow, J. A. MUNRO (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 518-521, pl. 1, fig. 1).—In this contribution from the North Dakota Experiment Station it is pointed out that in addition to recording the daily changes in weight of a hive of bees on scales, the beekeeper should also secure a daily record of weather data, since by the use of these two sets of records he will be better able to determine the factors which influence the yield of honey. A study of the records kept at the station indicated that excessive rainfall during the normal nectar

flow period was more responsible for decreased yield of honey than any other cause.

The influence of humidity upon sugar concentration in the nectar of various plants, O. W. PARK (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 534-544, figs. 3).—In this contribution from the Iowa Experiment Station the author reports having found the sugar concentration in nectar to vary inversely with the relative humidity. Correlation between these two factors was found to be much closer in some types of flowers than in others. The Abbé refractometer was found highly satisfactory for determining sugar concentration in nectar.

ANIMAL PRODUCTION

Principles of feeding, O. KELLNER, edited by G. FINGERLING (*Grundzüge der Fütterungslehre*. Berlin: Paul Parey, 1929, 8. ed., rev. and enl., pp. VII+223).—A revision of this treatise in which the information has been brought up to date (E. S. R., 31, p. 563).

The feeding of domestic animals, N. HANSSON, trans. by F. VON MEISSNER, rev. by G. WIEGNER (*Fütterung der Haustiere*. Dresden and Leipzig: Theodor Steinkopff, 1929, 2. ed., rev. and enl., pp. XV+274, figs. 8).—This is the second edition, revised and enlarged, of the treatise previously noted (E. S. R., 56, p. 69).

Feeding value of some locally grown forage crops, H. W. ALBERTS (*Alaska Stas. Rpt.* 1928, pp. 18-20).—To determine the feeding value of locally grown crops, 6-lb. samples of common barley, oats, and a swamp sedge (*Carex cryptocarpa*) were cut at weekly intervals, stored until they reached a constant moisture content, and analyzed. The detailed results of all the analyses are given in tabular form, and a brief discussion of changes in the content of the plants during growth is also presented.

Two samples of silverberry bush (*Elaeagnus argentea*) were also analyzed, the results indicating that the seed, stems, and leaves are nutritious, and that the plant should be a valuable supplement in the ration of animals running on the range.

Commercial feeding stuffs, 1928-1929, J. M. BARTLETT (*Maine Sta. Off. Insp.* 132 (1929), pp. 17-48).—The usual report of the guaranteed and found analyses for protein, fiber, and fat of 678 feeding stuff samples collected for official inspection during the year ended June 30, 1929 (E. S. R., 60, p. 758).

Cattle, sheep, and goat production in the range country, compiled by E. B. HAWKS and E. W. McCOMAS (*U. S. Dept. Agr., Library, Bibliog. Contrib.* 19 (1928), pp. 78).—A mimeographed selected list of all publications of the U. S. Department of Agriculture and of the agricultural colleges, experiment stations, and State departments of agriculture of the 17 range States deemed useful in connection with the range industry.

[Feeding experiments with cattle at the Matanuska Station, Alaska], H. W. ALBERTS (*Alaska Stas. Rpt.* 1928, pp. 24, 25, fig. 1).—Continuing these studies (E. S. R., 60, p. 759), a comparison was made of the ability of 2 Holstein cows, averaging 920 lbs. per head, and 3 Holstein-Galloway cows, averaging 748 lbs. per head, to make gains on home-grown feeds. The ration fed consisted of oats and wheat straw and oat-pea silage, supplemented with a limited amount of mangels and concentrated feed. During the period from January 1 to April 4 the Holsteins made average gains of 57.5 lbs. per head, while the crossbreds gained 85 lbs. per head.

On June 1 these cows were turned on pasture, and to September 21 the Holsteins gained an average of 145 and the crossbreds 153.33 lbs. per head.

To compare the value of different rations, 2 lots of 4 cows each were fed. The ration in lot 1 consisted of 6 lbs. of a mixture of equal parts of ground oats and barley, 35 lbs. of oat-pea silage, and 8 lbs. of native hay per 1,000 lbs. of live weight. The ration in lot 2 was the same as above, except that 1 lb. of linseed meal and 2 lbs. of mangels replaced 5 lbs. of silage and 2 lbs. of hay. After 6 weeks' feeding the rations were reversed. During the first period lot 1 gained 25 lbs. per head and during the second period 105 lbs. per head. Lot 2 gained 135 lbs. per head in period 1 and 45 lbs. in period 2. When the ration containing linseed meal was fed, lot 1 produced 252 lbs. and lot 2 356 lbs. more milk per head than when the ration made up of home-grown feeds was used. There was practically no difference in the cost per 1,000 lbs. of body weight in the two rations.

[Experiments with beef cattle at the Mississippi Station] (*Mississippi Sta. Rpt. 1928, pp. 14-17*).—The results of three studies are noted.

Comparison of roughages for finishing steers, D. S. Buchanan.—To determine the feeding value of different types of roughages, 5 lots of 8 steers each, averaging approximately 728 lbs. per head, were fed for 120 days on a basal ration of cottonseed meal and Johnson grass hay. In addition the following roughages were fed in the respective lots: Corn silage, cottonseed hulls, no roughage, sorgo silage, and sagrains silage. The average daily gains were 1.95, 1.98, 1.69, 1.87, and 1.74 lbs. per head, respectively. The cost of feed per 100 lbs. of gain was cheapest in lot 4, followed in ascending order by lots 2, 1, 5, and 3, and the return per steer above feed cost ranked descendingly in the same order.

Management of the breeding herd, G. S. Templeton.—A lot of 16 calves wintered for 101 days on a ration of 1 lb. of cottonseed meal, 15 lbs. of sorgo silage, and 5 lbs. of good quality Johnson grass hay gained an average of 64 lbs. per head. Another lot of 10 yearling heifers receiving 5 lbs. of cottonseed meal, 25 lbs. of sorgo silage, and 8 lbs. of Johnson grass hay gained an average of 119 lbs. per head during the winter period. A third lot of 43 mature cows and 2-year-old heifers fed 1 lb. of cottonseed meal, 30 lbs. of sorgo silage, and 5 lbs. of poor quality Johnson grass hay made an average gain of 5 lbs. per head during the same period.

Effect and economy of shelter in wintering beef cattle, G. S. Templeton.—In this study 4 lots of cattle, consisting of 16 and 17 cows and 16 and 15 calves, respectively, were fed for 101 days. Lots 1 and 3 were under shelter, while lots 2 and 4 remained in the open. The ration fed consisted of 1 lb. of cottonseed meal per head in each lot, 30 lbs. of sorgo silage in lots 1 and 2, and 15 lbs. in lots 3 and 4, and 5 lbs. of hay, which in lots 1 and 2 was a poor quality carbonaceous hay and in lots 3 and 4 good quality Johnson grass. The average gain or loss per head was 27, -21, 64, and 52 lbs. in the respective lots.

Beef cattle production in Mississippi, G. S. Templeton (*Mississippi Sta. Bul. 268 (1929), pp. 1-31, figs. 9*).—A popular publication, combining the results of experimental work noted above or previously with information on the selection, management, feeding, and some of the common ailments of cattle.

Postmortem changes in animal tissues—the conditioning or ripening of beef, T. MORAN and E. C. SMITH (*[Gt. Brit.] Dept. Sci. and Indus. Research, Food Invest., Spec. Rpt. 36 (1929), pp. VII+64, figs. 26*).—In an investigation of the effect of ripening upon the quality of beef, it was found that the principal change during the ripening period was a general increase in palatability, particularly in the tenderness of the meat. Beef stored at 32 to 41° F. for 17 days reached the consumer practically unchanged, except for the improvement in palatability. This improvement was more noticeable in the cheaper cuts of meat than in the prime cuts.

The study led to the suggestion that beef be conditioned at a central depot, and that the following scheme be adopted: (1) The carcasses cooled for 1 to 2 days at 31 to 33°, (2) further storage while in sides or quarters at 36 to 38° until needed for use, and (3) stored for 24 hours at normal temperatures, 40 to 45°, before removal to the retail stores.

Handbook for the shepherd and the sheep raiser, H. WEBER and G. FLEISCHHAUER (*Lehrbuch für Schäfer und Schafhalter*. Berlin: Paul Parey, 1929, pp. VIII+160, figs. 30).—The first part of this practical treatise deals with the breeding, feeding, and management of sheep. The second part on the diseases of sheep and their prevention has been prepared by Fleischhauer.

Sheep raising in the Upper Peninsula, G. W. PUTNAM and V. A. FREEMAN (*Mich. Agr. Col. Ext. Bul. 86* (1929), pp. 15, figs. 8).—The adaptability of sheep to the cut-over lands of the Upper Peninsula of Michigan, together with the methods of breeding, feeding, and management under these conditions, are discussed in this popular publication.

Wintering the breeding ewes, H. H. LEVECK (*Mississippi Sta. Rpt. 1928*, pp. 17, 18).—Ewes averaging 108 lbs. per head were divided into 3 lots of 25 ewes each and fed an average daily ration of 0.28 lb. of corn, 0.44 lb. of cottonseed meal, and 0.28 lb. of wheat bran. In addition lot 1 received 1.07 lbs. of alfalfa hay, lot 2, 1.38 lbs. of Johnson grass hay, and lot 3, 1.28 lbs. of soybean hay. For the first 51 days of the test there was little difference in the condition of the ewes. The lot receiving Johnson grass hay, however, failed to produce as much milk as the other lots and was discontinued at this time. The alfalfa and soybean groups were continued during the wintering period of 79 days without any noticeable difference in the ewes and lambs of the 2 lots.

[Swine feeding tests at Langdon, N. Dak.], V. STURLAUGSON (*North Dakota Sta. Bul. 228* (1929), pp. 7, 8, 23, 24).—Results of two studies are noted.

Hogging off peas.—In this study the average production of pork per acre of peas was 396 lbs. in 1926 and 310 lbs. in 1927. During the first test 5.5 acres fed 3 sows and 25 spring pigs for 70 days, during which time they made an average daily gain of 1.1 lbs. per head. The peas were supplemented with a small amount of oat chop. The Canadian Beauty variety of peas, sown at the rate of 2 bu. per acre, was used. In the second test 3.5 acres of peas fed 2 sows and 14 spring pigs for 68 days, during which time they gained at the rate of 1 lb. per head daily. In this trial a mixture of varieties of peas, sown at the rate of 2 bu. per acre, was used.

Hogging off peas and barley.—For a period of 12 days, beginning August 10, 17 pigs, averaging 59.1 lbs. per head, were turned on 2 acres of barley. Half of the area had been cut and shocked and the other half left standing. During this period the pigs gained 135 lbs., or an average of 0.7 lb. per head daily. On August 22 the pigs were turned on 2.5 acres of peas for a period of 67 days and also given access to the barley field. During this period the pigs gained 1,595 lbs., or an average of 1.4 lbs. per head daily. There was considerable barley left in the field, especially in that part which had been sown to bearded barley. The pigs showed a preference for barley in the shock as compared with standing grain. Although the gains on barley were unsatisfactory, the combined results showed that the 4.5 acres produced 384.4 lbs. of pork per acre. At 7.5 cts. per pound for pork each acre in the test returned \$28.83.

Hogging-off peas [at Hettinger, N. Dak.], C. H. PLATH (*North Dakota Sta. Bul. 229* (1929), pp. 19, 20, fig. 1).—Eight pigs averaging 113 lbs. per head on August 10 were turned on a 3-acre field of Chang field peas sown in rows 6 in. apart at the rate of 2 bu. per acre. In addition to the peas each pig received the following ration: 1 gal. of skim milk, 1 lb. of ground barley and oats, equal parts, and free access to a green pasture of mixed tame grasses.

During the 3 months of the test the pigs made a total gain of 1,085 lbs., or an average gain of 1.5 lbs. per head daily. The daily gains varied from 1.16 lbs. per head at the beginning of the test to a maximum of 1.81 lbs. per head. In this test 362 lbs. of pork were produced from 1 acre of peas, 240 lbs. of ground feed, 240 gal. of skim milk, and grass pasture. After deducting the cost of the supplementary feeds from the value of the pork, it was found that a return of \$22.94 per acre was made.

Throughout the experiment the pigs were very thrifty and had slick hair coats, indicating that it may be advisable to feed both the two protein-rich feeds, peas and skim milk, when the latter is produced on the farm.

Fattening bacon pigs on pasture with supplement of barley, whey, and fish meal [trans. title], J. C. DE RUYTER DE WILDT (*Dept. Binnenland. Zaken en Landb. [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 33 (1928), pp. 120-162, pl. 1; Ger. abs., pp. 147-149; Eng. abs., pp. 150-152*).—In an effort to find satisfactory supplementary feeds for pigs being fattened on pasture, two trials were conducted using two lots of 12 pigs each, averaging 22.33 kg. (49.1 lbs.) per head in the first test and 20.7 kg. each in the second test. The basal ration consisted of barley, whey, and dicalcium phosphate, and the experimental lot received in addition to the basal ration 150 gm. of fish meal in the first test and 200 gm. in the second test.

The average daily gains were 0.495 and 0.524 kg. per head in trial 1, and 0.46 and 0.485 kg. per head in trial 2, in the respective lots. In the second test the value of the results was somewhat obscured by the fact that 1 pig from lot 1 and 3 from lot 2 had to be discarded. While the addition of fish meal increased the rate of gain, it also increased the cost of gains to a point where it was not economical.

There was no significant difference in the quality of carcasses produced in the various lots. The cured hams had no off-flavors or taste, nor was there any difference in the quality of the hams from the various lots. The average iodine number of the fat from the fish meal-fed pigs was 56.02 and from the other pigs 55.03, which indicates that no significant difference exists.

[Experiments with mules at the Mississippi Station], G. S. TEMPLETON (*Mississippi Sta. Rpt. 1928, pp. 13, 14*).—Two experiments are noted.

[*Mule feeding experiments*].—The third year's results in this study checked quite closely with previous results. On the average 11 lbs. of good-quality Laredo soybean hay was equal in feeding value to 12 lbs. of No. 1 and No. 2 Johnson grass hay when fed with ear corn.

Lot-fed mules consumed about the same amount of hay and about 22 per cent more corn than stall-fed mules, and the former gained more in live weight than their team mates fed in stalls.

Salt requirements of work mules.—Mules used for heavy farm work showed a marked difference in their individual requirements for salt when it was available at all times. Consumption ran as high as 0.46 oz. per 1,000 lbs. daily during the period of heavy work in the spring and summer, decreasing to about 0.3 oz. during the fall and winter. The average consumption was 0.4 oz. per 1,000 lbs. of live weight daily.

Poultry science and practice, R. H. WAITE (*New York and London: McGraw-Hill Book Co., 1929, pp. IX+433, figs. 337*).—A practical treatise dealing with the breeding, feeding, and management of poultry, in which the author has evaluated and placed on an equal footing the newer scientific findings and the older established facts.

[Experiments with poultry at the Mississippi Station], E. P. CLAYTON (*Mississippi Sta. Rpt. 1928, pp. 41, 42*).—When 450 hens and pullets, mostly hens in molt, were allowed free access to grain and mash in hoppers, they consumed

from November to March, inclusive, considerably more grain than mash. While growing new feathers during November and December very small amounts of the mash were consumed. The egg production of the lot receiving the grain and mash was much higher, especially during November, December, and January, than that of the lot receiving mash alone.

The early embryology of the chick, B. M. PATTEN (*Philadelphia: P. Blakiston's Son & Co., 1929, 3. ed., pp. XIII+228, pl. 1, figs. 87*).—A revised and enlarged edition of this treatise, previously noted (*E. S. R.*, 53, p. 577).

Turkeys in Montana, H. E. CUSHMAN and H. WELCH (*Mont. Agr. Col. Ext. Bul. 101 (1929), pp. 35, figs. 16*).—A popular publication dealing with the selection, management, breeding, feeding, and marketing of turkeys. The section on Diseases and Parasites of Turkeys was prepared by H. Welch.

The model rabbit hatch, J. ROBILLOX (*Le Clapier Modèle. Paris: S. Bornemann, 1929, pp. 232, figs. 71*).—A practical treatise on the breeding, feeding, housing, and management of rabbits, together with information on the principal products of rabbits.

DAIRY FARMING—DAIRYING

[Minutes of the thirteenth and fourteenth annual meetings of the western division of the American Dairy Science Association] (*Amer. Dairy Sci. Assoc., West. Div., Minutes Ann. Meetings, 13 (1927), pp. [65]; 14 (1928), pp. [100]*).—The proceedings, in mimeographed form, of the thirteenth and fourteenth annual meetings of the western division of the American Dairy Science Association, held at Portland, Oreg., October 30 and 31, 1927, and November 4 and 5, 1928.

[Experiments with dairy cattle at the Mississippi Station], J. S. MOORE (*Mississippi Sta. Rpt. 1928, pp. 20, 21*).—The results of two studies are noted.

Sagrain v. corn chops.—A comparison of sagrain seed and corn chops as feeds for dairy cows was made, using 2 lots of 4 cows each, fed by the reversal method for 3 periods of 4 weeks each. The ration used was the same except that during one period the cows received sagrain seed and in the next an equal amount of corn chops. On the sagrain ration the cows lost an average of 70 lbs. per head and produced 5,358.1 lbs. of milk containing 251.05 lbs. of butterfat. On the corn chops ration there was an average loss in body weight of 110 lbs. per head, but the cows produced 6,194.3 lbs. of milk containing 266.83 lbs. of butterfat.

Weight of calves at birth and comparison of birth weights to weights of dam.—The average birth weight of 118 Jersey male calves was 51.4 lbs. as compared with 48.9 lbs. for 139 Jersey female calves. These birth weights represent 5.7 and 5.4 per cent, respectively, of the dam's weight before calving and 6.4 and 6 per cent after calving. For the Ayrshire breed the average birth weight of 43 male calves was 70.5 lbs. and of 34 female calves 67.6 lbs. The birth weights represent 6.7 and 6.4 per cent of the dam's weight before calving and 7.5 and 7.1 per cent after calving. The average gestation period was 279.5 days for the Jersey breed and 281.5 days for the Ayrshire breed.

Methods of balancing rations for dairy cows in digestibility trials with corn meal, C. W. HOLDAWAY, W. B. ELLETT, and J. F. EHEART (*Virginia Sta. Tech. Bul. 38 (1929), pp. 10*).—Continuing the digestibility studies (*E. S. R.*, 59, p. 467), a mixed hay having a protein-energy ratio of about 1:8 was fed with a mixture of 75 per cent corn meal and 25 per cent special gluten feed. The concentrated mixture had about the same nutritive ratio as the hay. The above ration was fed during the first period, hay alone during the second in amounts so that about the same amount of dry matter was consumed daily.

and hay and corn meal in a third period. The last ration had a wider protein-energy ratio than the first.

As in previous experiments it was found that when the protein-energy ratio was widened, as occurred when corn meal was added without supplementary protein-rich feed, the digestibility of the protein of the whole ration was depressed. In these tests a higher protein coefficient for corn meal was found than is given by Henry and Morrison.

Corn chops vs. cane molasses for milk production in Porto Rico, W. M. ELLISON and J. VARAS CATALÁ (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt. 1928, Eng. ed., pp. 99, 100*).—In this study 2 groups of 6 cows each were fed for 30 days. The grain ration consisted of wheat bran, alfalfa meal, cottonseed meal, linseed oil meal, steamed bone meal, and salt. In addition lot 1 received cane molasses and lot 2 corn chops. The forage for both lots consisted of a poor quality of sugar cane tops mixed with some grasses.

Lot 2 consumed 30 lbs. more feed and produced 201.6 lbs. more milk at a feed cost of \$8.30 more than lot 1. This work indicates that where molasses can be purchased in quantity at a very reasonable cost, it may replace the high-priced grains in a ration for dairy cows.

Two comparisons of the feeding value of ensiled grass and hay for dairy cattle [trans. title], E. BROUWER (*Dept. Binnenland, Zaken en Landb. [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 33 (1928), pp. 10-75; Ger. abs., pp. 40-47*).—In these studies ensiled grass was found to be an excellent feed for dairy cows. In the first test, when both silage and hay had been prepared under excellent conditions, 100 kg. of dry matter in the silage had the same feeding value as 105 kg. of dry matter in the hay. In the second test when the conditions for curing hay were poor, 100 kg. of dry matter in the silage was equal to 120 kg. of dry matter in the hay.

The author points out that as the result of this study it has been found not advisable to compare two such feeds on the basis of their dry matter alone.

The vitamin C content of ensiled grass [trans. title], E. BROUWER (*Dept. Binnenland, Zaken en Landb. [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 33 (1928), pp. 95-106, figs. 2; Ger. abs., p. 106*).—Experiments with cattle showed that the vitamin C content of ensiled Netherlands grass was very poor. The cattle fed such silage showed unmistakable signs of vitamin C deficiency.

[Milk production records in Alaska], H. W. ALBERTS (*Alaska Stas. Rpt. 1928, pp. 16, 17, 24, fig. 1*).—The average daily milk yield of a Galloway cow at the Fairbanks Station was 10 lbs. The record covers one entire lactation period and part of another, and the calving dates were April 13, 1927, and April 4, 1928. The average fat content of the milk was 4.7 per cent. In comparison a yak-Galloway hybrid calving on November 6, 1927, had an average milk production of 10.5 lbs., containing 6 per cent butterfat during one lactation period.

At the Matanuska Station an F₁ Holstein-Galloway cow in her fourth lactation period of 365 days produced 12,010.9 lbs. of milk, while an F₂ Holstein-Galloway heifer in her first lactation period of 365 days produced 7,318.7 lbs. of milk. The daily average milk yield of these two cows was 32.87 and 20.05 lbs. per head, respectively.

Bacteriological studies of milking machines, C. K. JOHNS and A. G. LOCHHEAD (*Jour. Hyg. [London], 29 (1929), No. 1, pp. 35-50, fig. 1*).—The value of the milking machine for producing high-grade milk has been studied at the Central Experimental Farm, Canada. It was found that the sanitary condition of the rubber parts was the most important factor effecting the bacterial

count of machine-drawn milk, and that such factors as washing the udder, discarding the foremilk, and handling the teat cups assumed importance only when the rubber parts were efficiently sterilized.

Efficient sterilizing depended upon the thoroughness of the preliminary washing, which was accomplished by suction. Washing alone was not a safe method for obtaining low-count milk. Steam, hot water, and chemical solutions were all satisfactory sterilizing agents, but the heat methods shortened the life of the rubber parts more than equally effective chemical treatments. The chloramine-brine treatment was as effective as the hot-water treatment and in operation much simpler and more economical for controlling bacterial contamination. Milk drawn by machines that had been carefully sterilized was equal in quality to milk produced by careful hand milkers.

First-grade cream and cream tests, E. O. CHALLIS (*Union So. Africa Dept. Agr. Bul.* 52 (1929), pp. 16, figs. 8).—The principles involved in the production of first-grade cream are outlined in this publication.

The effect of pasteurizing cheese milk on the breaking down of albumin in Edam cheese [trans. title], W. VAN DAM (*Dept. Binnenland. Zaken en Landb. [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta.*, No. 33 (1928), pp. 187–200; *Eng. abs.*, p. 200).—In this study it was found that the higher the temperature of pasteurizing, the smaller were the amounts of disintegration products from the proteins. When the pasteurizing temperature was high the flavor of the cheese developed slowly, an excellent body was obtained without difficulty, and the character of the flavor remained unchanged. The differences found increased according to the degree to which the milk was heated and to the age of the cheese.

The use of egg yolk in ice cream, W. H. MARTIN and W. J. CAULFIELD (*Jour. Dairy Sci.*, 12 (1929), No. 3, pp. 193–201).—Concluding this study at the Kansas Experiment Station (E. S. R., 61, p. 171), it was found that the improvement in the whipping qualities of mixes through the use of egg yolks depended upon the composition and age of the mix and upon the concentration of egg yolk used. Egg yolk improved the whipping qualities of relatively heavy, slow-freezing mixes to a greater extent than those of mixes with a comparatively low solid content. The improvement in whipping qualities was in most cases directly proportional to the concentration of egg yolk, but when less than 0.5 per cent of yolk was used little or no influence was exerted on body, texture, appearance, or flavor of mixes containing the correct proportions of milk solids and sugar. Egg yolks imparted a flavor that was at times objectionable, and this was most noticeable in mixes of low solid content.

VETERINARY MEDICINE

Guide to post-mortem diagnosis, with directions for dissection, L. LUND (*Pathologisch-anatomische Diagnostik an Tierleichen mit Anleitung zum Sezieren. Hannover: M. & H. Schaper, 1929, pp. IX+303, figs. 108*).—A handbook on post-mortem diagnosis.

Investigations of the topography of the abdominal organs in cattle and some clinical observations and remarks in connection with the subject, N. LAGERLÖF (*Skand. Vet. Tidskr.*, 19 (1929), No. 8, pp. 253–365, pls. 80).—A detailed report of studies conducted, presented in connection with a list of 57 references to the literature.

Practical bacteriology: An introduction to bacteriological technic, F. W. TANNER (*New York: John Wiley & Sons; London: Chapman & Hall, 1928, pp. XIV+235, figs. [74]*).—This is a laboratory guide for the beginner in bacteriology.

Animal parasitology, R. HEGNER, F. M. ROOT, and D. L. AUGUSTINE (*New York and London: Century Co., 1929. pp. XXI+731, figs. 281*).—The introduction (pp. 1-22) and section 1 on protozoology (pp. 23-185) are by Hegner. Section 2 on helminthology (pp. 187-460) is by Augustine, and section 3 on medical entomology (pp. 461-640), including notes on collecting and preserving insects of medical interest (pp. 637-640), is by Root. A bibliography (pp. 641-697), an author index (pp. 699-707) and a subject index (pp. 709-731) are included.

Diseases of animals in tropical countries, C. R. EDMONDS and G. K. WALKER (*London: Baillière, Tindall & Cox, 1929, 2. ed., pp. XI+407, figs. 37*).—This is the second edition of a work previously noted (*E. S. R.*, 47, p. 283), the scope of which has been extended to tropical regions.

Fifty years of pathology, E. F. SMITH (*Internat. Cong. Plant Sci., [Ithaca, N. Y.], Proc., 1926, vol. 1, pp. 13-46, pls. 34, fig. 1*).—This address, previously referred to (*E. S. R.*, 55, p. 104), deals with animal as well as plant pathology. Of the workers, photographs of 9 of which are given on each of 30 plates, a large proportion are animal pathologists.

[Contributions on comparative pathology in Australia] (*Aust. Vet. Jour., 5 (1929), No. 2, pp. 43-81, figs. 2*).—The papers presented include the following: The Buffalo Fly Menace in Queensland, by J. Legg (pp. 43-46); Caseous Lymphadenitis from the Commercial and Meat Inspection Aspect, by J. F. McEachran and G. K. Thorpe (pp. 46-49); A Discussion of the Method of Infection by *Bacillus of Preisz-Nocard*, by H. R. Seddon (pp. 49-54); "Swelled-Head" in Rams, by L. B. Bull (pp. 54, 55); Some Observations Bearing upon the Aetiology of Black Disease, by G. Edgar (pp. 55-59); Poisoning of Sheep by Soursofs (*Oxalis cernua*): Chronic Oxalic Acid Poisoning, by L. B. Bull (pp. 60-69) (noted on p. 170); Observations on the Treatment of Parasitic Gastritis in Sheep, by H. R. Seddon and I. C. Ross (pp. 69-71); Skin Cancer in Cattle, by J. Drabble (pp. 71-76); Preliminary Note on the Pre-parasitic Stages in the Life Cycle of *Stephanurus dentatus* Diesing, 1839, by I. C. Ross and G. Kauzal (pp. 77, 78); Streptothrix Disease in Kangaroos, by A. S. Le Souef and H. R. Seddon (pp. 79, 80); and Buffalo Fly Menace: Grave Danger to Australia (pp. 80, 81).

[Studies of comparative pathology in Japan] (*Jour. Japan. Soc. Vet. Sci., 8 (1929), No. 2, pp. 75-128, pl. 1*).—The contributions here presented are as follows: Diagnosis of Glanders by Precipitation with So-called "Soluble Specific Substance" Derived from *B. mallei*, by K. Sakamoto (pp. 75-85: Eng. abs., p. 85); On a Method of Microanalysis of Magnesium, by S. Suzuki (pp. 86-94; Eng. abs., pp. 93, 94); Studies on the Drug Fastness of Rat-Bite Fever Spirochete, *Spirochaeta morsus muris*—1. Bismuth Fastness, by S. Akazawa (pp. 95-118; Eng. abs., pp. 117, 118); and A Study of Sarcosporidia in Korean Cattle, by S. Nakanishi (pp. 119-128; Japan. abs., pp. 127, 128).

Administration report of the Government veterinary surgeon for 1928, G. W. STRUBESS (*Ceylon Govt. Vet. Surg. Rpt. 1928, pp. 12*).—This (*E. S. R.* 61, p. 371) includes an account of the occurrence of and work with infectious diseases of livestock and a review of the work of the staff in the provinces.

Disinfection experiments on foreign anthrax skins [trans. title], R. STANDFUSS and G. POHL (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 32 (1927), No. 1, pp. 23-56; abs. in Vet. Rec., 9 (1929), No. 30, p. 639*).—Of the methods tested in the disinfection of anthrax-infected hides, chemically pure sodium sulfide in an 8 to 10 per cent solution gave the best results.

Some anthrax transmission experiments with tabanids, muscids, and culicids [trans. title], O. NIESCHULZ (*Dept. Landb., Nijv. en Handel Nederland. Indië, Veeartsenijk. Meded., No. 67 [1928], pp. 1-23; Ger. abs., pp. 21-23; abs. in*

Trop. Vet. Bul., 17 (1929), No. 2, pp. 56, 57).—Anthrax transmission experiments were conducted with Diptera representing 9 species. With *Tabanus rubidus* Wied. direct transmission took place in every experiment, and a varying degree of success was obtained in those in which the interval between feeds was gradually increased. With an interval of 3 days 2 experiments out of 6 yielded positive results, but with a 4-day interval, 7 experiments, using 16 flies, all gave negative results. Similar results were obtained with *T. striatus* Fab. With *Chrysops flaviventris* Macq. direct transmission was successful, and in 1 of 5 experiments transmission occurred when one-half hour had elapsed; no positive results were obtained after an hour. With the stable fly, *Lyperosia exigua* De Meij., and *Musca inferior* Stein only direct transmission experiments were conducted, and these gave positive results. In 45 experiments conducted with *Anopheles* (*Nyssorhynchus*) *fuliginosus* Gil., *Aedes* (*Stegomyia*) *fasciata* Meig., and *Armigeres obturbans* (Walk.), using 300 insects, 1 experiment only yielded a positive result.

These experiments were conducted with guinea pigs, and the possibility of securing similar results with larger domestic animals is questioned.

Some blackleg and related disease transmissions with Tabanidae [trans. title], O. NIESCHULZ and F. L. HUBER (*Dept. Landb., Nijt. en Handel Nederland. Indië, Veerartsenijk. Meded.*, No. 67 [1928], pp. 24-27; *Ger. abs.*, pp. 26, 27; *abs. in Trop. Vet. Bul.*, 17 (1929), No. 2, p. 57).—In experiments conducted at the Veterinary Institute at Buitenzorg a single specimen of *Tabanus rubidus* Wied. transmitted blackleg from a calf to a guinea pig. Experiments with *T. striatus* Fab. failed in every instance, and it is considered doubtful whether the part played by these flies has any practical significance.

The infectivity of the urine, feces, bile, and milk of animals affected with foot-and-mouth disease [trans. title], K. TRAUTWEIN, E. THOMASHOFF, and K. R. HÖVE (*Arch. Wiss. u. Prakt. Tierheilk.*, 58 (1928), No. 2, pp. 158-171; *abs. in Trop. Vet. Bul.*, 17 (1929), No. 2, pp. 61, 62).—In experimental work conducted with the guinea pig the authors found the urine and the feces to contain the foot-and-mouth disease virus in about 3 per cent of the cases, and that it is present from about the eighteenth hour after infection. It was found up to the fifty-sixth hour in feces and up to the ninetieth hour in urine. The bile was infective in nearly 10 per cent of the cases and for approximately the same period as the urine.

In experimental cattle the urine contained the virus in about 17 per cent and the feces in 7 per cent of the cases. Excluding animals in which only primary lesions developed, the virus was present in a much higher percentage, the urine being infective in 36.5 per cent, the feces in 17 per cent, and the blood in 56 per cent of the cases. The virus could be found in the urine and feces from the fifteenth to the one-hundred-and-third hour after infection, but could not be detected in the blood in every case in which it was present in the urine and feces. The bile of 71 immune cattle was tested, but the virus was not detected in any instance.

Fifty-eight pigs infected from foot-and-mouth disease were slaughtered from 40 to 50 hours after infection. The urine was found to be infective in about 5 per cent of the cases and the bile in 1.7 per cent, but the virus was not detected in the feces. The milk of 18 infected guinea pigs was tested, and the virus was found in 83 per cent. Its presence was demonstrable from the twelfth to the seventy-seventh hour. In most cases the blood was also infective. In 30 per cent of the cases (17) the milk contained the virus. It was first found at the thirteenth hour, and the latest time of detection was the one-hundred-and-thirteenth hour. The blood was in most cases also infective.

An investigation of the serological relationships of twenty-six strains of *Pasteurella*, J. T. CORNELIUS (*Jour. Path. and Bact.*, 32 (1929), No. 3, pp. 355-364).—The author has found it possible by means of agglutinin-absorption tests to group 17 *Pasteurella* strains out of 26; group 1 containing 7; group 2, 5; group 3, 3; and group 4, 2 strains. The remaining 9 strains defied classification. Complement-fixation tests carried out with two group 1 strains and a number of sera partially confirmed this grouping. No relationship between the serological group and the animal origin of the strains was evident.

Filterable virus and Rickettsia diseases, E. B. MCKINLEY (*Philippine Jour. Sci.*, 39 (1929), No. 1-4, pp. 416. pls. 70, figs. 7).—Following an introductory chapter (pp. 9-37), chapters 2, 3, and 4 deal with filterable virus diseases of man and animals (pp. 38-151), and the following chapters with bacterial diseases of man and animals (pp. 152-173), insect-borne diseases of man and animals (filterable) (pp. 174-197), filterable virus diseases of animals (pp. 198-243), other possible filterable virus diseases of man (pp. 244-261), the Rickettsia diseases of man and animals (pp. 262-292), filterable virus diseases of fowls (pp. 293-318), filterable virus diseases of insects (pp. 319-331), filterable virus diseases of fishes (pp. 332-343), filterable virus diseases of plants (pp. 344-367), the bacteriophage (pp. 368-380), filterable forms of bacteria, yeasts, and spirochetes (pp. 381-389), intracellular inclusions in filterable virus diseases (pp. 390-411). A subject index is included.

B. C. G. vaccination against bovine tuberculosis [trans. title], A. CALMETTE and C. GUÉRIN (*Rev. Gén. Méd. Vét.*, 38 (1929), No. 451, pp. 385-392).—This is a reply to the report of Schroeder and Crawford, previously noted (El. S. R., 61, p. 271).

Undulant fever (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 12, pp. 891-903).—A discussion of the etiology, epidemiology, and laboratory diagnosis of undulant fever by A. V. Hardy (pp. 891-897), followed by an account of the clinical characteristics based on a study of 150 cases observed in Iowa by W. L. Bierring (pp. 897-901). In the discussions that follow attention is drawn by J. Traum of the California Experiment Station to the fact that while a cow may react negatively to the agglutination test for *Brucella abortus* and still eliminate organisms in the milk such a condition rarely occurs.

Undulant fever (Bang) of man [trans. title], K. POPPE (*Deut. Tierärztl. Wchnschr.*, 36 (1928), No. 47, pp. 781-786, fig. 1).—This account is presented in connection with a list of 75 references to the literature.

Undulant fever presenting the clinical syndrome of intermittent hydrarthrosis, B. M. BAKER, JR. (*Arch. Int. Med.*, 44 (1929), No. 1, pp. 128-141, figs. 6).—A case of undulant fever arising in Virginia due to *Bacillus abortus* is reported at length. In addition to many of the features of undulant fever the patient presented a periodic swelling of the knee joints, diagnosed as intermittent hydrarthrosis. Specific agglutinins appeared in the blood after the administration of an autogenous vaccine, and definite disappearance of the signs and symptoms of the infectious disease followed the administration of undulant fever vaccine and serum from a patient who had recovered from the disease. There was amelioration of the subjective joint disturbances and a temporary alteration in the hydrarthrosis following this treatment.

The treatment of undulant fever by a protein extract from *Brucella abortus* [trans. title], F. TOULLEO and M. BLANCHARD (*Bull. Soc. Path. Exot.*, 22 (1929), No. 3, pp. 150-152, fig. 1).—The author reports upon the cure of a grave case of undulant fever by a single intramuscular injection of 1 cc. of the

B. abortus endoglobulin or endoprotein of Reilly and Cambessèdes. After the injection the temperature fell to and remained at or near normal, and the patient was discharged on the seventeenth day following as cured.

Experiments in the control of Johne's disease (paratuberculosis) in a herd of dairy cattle, C. B. CAIN (*Mississippi Sta. Rpt. 1928, pp. 21-23*).—This is a brief report of progress in experimental work with Johne's disease in the college herd. As a result of the application of the intravenous johnin test on June 8, 9, and 10, 1927, the cattle in the herd were classified into three groups—reactors, suspects, and nonsuspects. The reactors and suspects were removed to a separate part of the farm, the premises where the nonreactors were retained being thoroughly disinfected. None of the four calves taken from cattle in the reactor herd, which were subjected in November to the intravenous test, reacted.

Thus far, the author has been unable to secure a noticeable reaction with intradermal injections of johnin.

Some notes on the poisoning of sheep by soursofs (*Oxalis cernua*) (*Jour. Dept. Agr. No. Aust., 32 (1929), No. 11, pp. 918, 919*).—Investigations conducted by [L. B.] Bull, director of the laboratory of pathology and bacteriology at Adelaide Hospital, have shown that if sheep are grazed on *O. cernua* for 7 or 8 weeks or longer sickness and deaths may occur as the result of chronic poisoning. The poisoning is caused by the oxalic acid which is present in large quantities in this plant. Two types of the disease have been observed and are described.

Anaplasmosis of sheep in Russia [trans. title], W. L. YAKIMOFF, S. A. AMANSCHOULOFF, AREOUSOFF, and SCHOUAWLEFF (*Bul. Soc. Path. Exot., 22 (1929), No. 6, pp. 423, 424*).—A preliminary note in which the authors record the detection of the first case of anaplasmosis in sheep known to occur in Russia.

[Medical treatment for sheep parasites], S. W. GRENE (*Mississippi Sta. Rpt. 1928, p. 63*).—It is reported that in work at the Coastal Plain Substation intestinal parasites of sheep were controlled through drenching at 2-week intervals with both bluestone and carbon tetrachloride.

Stovarsol is specific for contagious agalaxia of the sheep and goat [trans. title], J. BRIDÉ, A. DONATIEN, and D. HILBERT (*Bul. Acad. Vet. France, 1 (1928), No. 7, pp. 297-300; abs. in Trop. Vet. Bul., 17 (1929), No. 2, p. 65*).—Brief details are given of 11 cases of agalaxia complicated by simple or multiple arthritis, in which a 10 per cent solution of sodium stovarsol was administered subcutaneously. In some cases a series of three injections of 5, 7.5, and 10 cc. given at intervals of 24 hours effected a complete cure, while in others a second series of three injections was given after an interval of three days.

Studies on the dissociation of the hog cholera bacillus, I, II, C. P. LI (*Jour. Expt. Med., 50 (1929), No. 2, pp. 245-262, pl. 1*).—Part 1 (pp. 245-253) of this account deals with the isolation and differentiation of dissociants, and part 2 (pp. 253-262) with the serological reactions, virulence, and stability of the variant forms.

A method of counting white cells in the blood of fowl (*Ontario Vet. Col. Rpt. 1928, p. 63*).—A method is described which gives uniform results.

Bacillary white diarrhoea (B. W. D.): *B. pullorum* isolated from a turkey poult in England, T. DALLING, J. H. MASON, and W. S. GORDON (*Vet. Rec., 9 (1929), No. 41, p. 902*).—The authors here report what is thought to be the first record of the isolation of *Bacterium pullorum* from a turkey poult in England, it having been isolated from the liver of one of two sent to the laboratory for post-mortem examination. It is thought probable that these

6-weeks-old poults became infected from chicks, having been hatched under hens and having used the same runs as chicks.

Bacillary white diarrhea or pullorum disease in the pheasant [trans. title], B. GALLI-VALERIO (*Schweiz. Arch. Tierheilk.*, 70 (1928), No. 12, pp. 581-585; *abs. in Ann. Med. Vet.*, 74 (1929), No. 6, pp. 273, 274).—In rearing the common pheasant (*Phasianus colchicus*) in Switzerland a great number of the eggs failed to hatch, while the chicks that hatched out were weak and many died in a few days. The author's studies which followed have shown the pheasant to be subject to pullorum disease, the affection being similar clinically and pathologically to that found in the hen. The causative organism was frequently detected in the ovary but was rarely found in the blood. The three pheasants tested reacted positively to the agglutination test at a dilution of 1 to 25.

The author concludes that *Bacterium pullorum* is represented by varieties in different species of birds and gives the name *B. pullorum phasiani* to the variety worked with.

The viability of the *B. pullorum* in the tissues of the dead chick (*Ontario Vet. Col. Rpt.* 1928, pp. 32, 33).—(*Bacterium*) *Salmonella pullorum* was found to be highly resistant against putrefactive changes, there having been some evidence of a multiplication of the organism during the first few days in tissues of the dead chick. The numbers of *S. pullorum* in tissues were found to be maintained after 10 days, as was determined by cultures taken from the livers of affected birds. At the end of 24 hours *S. pullorum* was obtained in pure culture, the carcass being in good condition. The plates were heavy with the organism at the end of 96 hours, the body being badly decomposed. Equal numbers of *S. pullorum* and other colonies were present at the end of 10 days when the body was in a very bad condition.

Prophylaxis for bacillary white diarrhea in an infected flock [trans. title], A. STAUD and C. TRUCHE (*Bul. Acad. Vét. France*, 2 (1929), No. 6, pp. 183-189).—This account deals in large part with methods of diagnosis for pullorum disease—particularly the agglutination test.

Salmonella pullora studies, R. GWATKIN (*Ontario Vet. Col. Rpt.* 1928, pp. 45-52).—In a further comparison (*E. S. R.*, 59, p. 582) for the detection of carriers of *S. pullorum*, the organism was recovered from 19 of 22 agglutination positive birds and from none of the 15 pullorin positive birds examined. In a further comparison of the rapid and regular agglutination tests with *S. pullorum* antigen the two methods were equally satisfactory with the antigen employed.

In a study of the production of gas in dextrose by *S. pullorum* 9 out of 17 stock cultures failed to produce gas at 37° C. in 1 per cent dextrose broth with a reaction of pH 7.8, 7 of the 9 strains having originally been gas producers. Eight of the 9 cultures eventually produced gas at 30° in Goodner and May (*E. S. R.*, 57, p. 576) dextrose broth. The ninth strain was passed through 17 different lots of this broth without evidence of gas production, although it had formed gas when isolated 2 years previously. The addition of 1 per cent of normal sodium hydroxide to *S. pullorum* antigen prevented cloudy reactions in a comparison of 100 unreadable sera. The sensitivity of the antigen was increased in 4 out of 10 sera which were set up in dilutions of 1 : 50, 1 : 100, 1 : 250, and 1 : 500 in antigen alone and with quantities of the soda solution varying from 1 to 5 per cent. In the other 6 it remained the same.

A quantitative study of poultry coccidiosis, with data on the prepatent and patent periods in the life cycle of Eimeria avium, B. P. YOUNG (*Jour. Parasitol.*, 15 (1929), No. 4, pp. 241-250, fig. 1).—It was found that the prepatent period of avian coccidiosis, using Barred Plymouth Rock chicks and segmented oocysts, is from 4 to 5 hours less than 4 days. "Unsegmented oocysts ingested

a few hours after being voided by the host may produce coccidiosis, while unsegmented oocysts ingested from 12 to 18 hours after being shed are quite likely to produce the disease. The length of time a chick will retain oocysts within its intestine is a factor in infections. Oocysts apparently do not begin to segment until after exposure to the air. No sign of segmentation could be seen in oocysts pent up in the rectum and cloaca of a chick for 2 and 3 days, respectively. Degeneration through the attack of bacteria was noted in the inclosed cytoplasm of many of these. If the chick is kept from reinfection the disease will run a rather limited course, but immunity to later infections does not seem to be developed by experimental inoculation.

"Measurements and color of oocysts seem to indicate the presence of two different organisms in some coccidiosis infections. These may represent two different species, *E. avium* (Rivolta and Silvestrini) and *E. tenella* (Railliet and Lucet). The appearance of fowl paralysis in a chicken which had been inoculated with oocysts a second time and had lived its entire life under two layers of cheesecloth supports the assumption that fowl paralysis is one of the symptoms of chronic coccidiosis rather than in no way connected with infestation with coccidia."

How coccidiosis may cause rickets, H. J. STAFSETH (*Hatchery Tribune*, 3 (1929), No. 6, pp. 30, 33).—Studies at the Michigan Experiment Station indicate that the presence of extensive inflammation of the mucous membranes of the intestines caused by coccidia prevents proper digestion and assimilation, resulting in rickets. It is pointed out that other microorganisms than coccidia, even intestinal parasites, capable of causing extensive and lasting injury to the mucous membrane of the intestines might bring about similar results.

Infectious tracheitis, R. GWATKIN (*Ontario Vet. Col. Rpt. 1928*, pp. 61–65).—The author found chicken pox virus present in 3 out of 4 cases of infectious tracheitis. The lesions produced in experimental birds were those of typical diphtheria and chicken pox, although in one case they were slight.

Neuritis or paralysis of fowls, L. P. DOYLE (*Poultry Sci.*, 8 (1929), No. 3, pp. 159, 160).—Studies conducted by the author at the Indiana Experiment Station indicate that paralysis of fowls may be transmitted from parent to offspring in much the same way as bacillary white diarrhea.

Subacute infections in fowl due to *Pasteurella avicida*, R. GWATKIN (*Ontario Vet. Col. Rpt. 1928*, pp. 55–58).—The author found several cases of wryneck to be due to *P. avicida*, and this condition was reproduced artificially by the injection into the submucosa of the eyelid of strains from roup eyes. The organism was recovered in pure culture from 13 out of 60 sporadic cases of peritonitis. It is concluded that *P. avicida* varies widely in virulence, which, combined with the varying resistance of the host, results in conditions that range from acute cholera to localized infections of joints and organs in the same flock.

Ten strains of *P. avicida* from cases of roup were examined, and 3 of the 6 strains injected into the submucosa of the eyelid of fowl produced a violent inflammation with intense swelling of the face and eye and also a generalized condition with the development of wryneck in 3 of the 4 injected birds. The organism was recovered from the brain of 2 of the fowls. The condition produced was more severe than is encountered in roup and there was absence of any discharge, but this may have been due to the method and location of the injection and the size of the dose.

An attempted transmission of *Spirochaeta gallinarum* to the fowl by *Ornithodoros savignyi* [trans. title], A. CATANZI (*Compt. Rend. Soc. Biol. [Paris]*, 100 (1929), No. 12, pp. 1018, 1019).—The author failed to transmit spirochetosis to the fowl or canary by nymphs that had fed on infected birds.

The canary was found, however, to be very susceptible to this spirochete when inoculated through the blood of an affected fowl.

Vermicidal action of iodine and kamala, R. GWATKIN (*Ontario Vet. Col. Rpt. 1928, pp. 59, 60*).—Worms were expelled from 2 of 16 birds infested with roundworms or tapeworms that were treated with a commercial iodine preparation. The remaining birds were shown to be all more or less heavily infested with living worms on post-mortem examination. Eight infested birds were treated with 1 gm. of powdered kamala, one of which had worms that were not killed by the drug, and another died 24 hours after the treatment. While the intestine was full of living tapeworms, owing to the condition in the crop it is doubtful if the kamala reached them. Two of the remaining 6 were found to be infested with living tapeworms on autopsy, and the other 4 were entirely free.

The disinfection of incubators with formaldehyde during hatching, R. GWATKIN (*Ontario Vet. Col. Rpt. 1928, pp. 53-55*).—In this further report of studies (*E. S. R.*, 59, p. 583) the author found that hatchability was not lowered by exposure to formaldehyde.

AGRICULTURAL ENGINEERING

Irrigation investigations on the peat lands in the Sacramento-San Joaquin Delta, L. N. BROWN (*Agr. Engin.*, 10 (1929), No. 8, pp. 249-252, figs. 6).—The results of general investigations of irrigation reclamation and practice on these lands are briefly presented and discussed.

Electricity in agriculture, C. A. C. BROWN (*Univ. Oxford, Inst. Research Agr. Engin. Bul. 5* (1929), pp. 75, pl. 1, figs. 15).—Part 1 of this report contains the results of an investigation in an electrified rural area in England. These indicated the predominance of the domestic load and that the most important farm load is that of the house. Data are given on the cost of different belt operations.

Part 2 is devoted to general considerations on the subject deduced mainly from the data recorded in part 1.

Appendixes deal with the use of electricity for tillage and with the consumption of electricity on farms in different areas.

Tests of strength and design of welded joints (*Heating, Piping and Air Conditioning*, 1 (1929), No. 5, pp. 381-387, figs. 8).—The results of an investigation of oxyacetylene welded pipe joints are reported.

These indicate that a properly made oxyacetylene welded joint is as strong as the pipe—fully 100 per cent efficient. The single V-type butt joint is the most efficient and is recommended for use in welding pipe. This is in agreement with past experience, as this design is practically universally used in pipe work.

Very high strength and nearly equally satisfactory results were obtained with the normal socket and socket with groove joints. In joint design, however, other factors must be considered, as cost of preparation, stress distribution under strain, and ease of welding, which make these designs less satisfactory than the single V-type butt joint. The weakest joint was the socket with welded rivets. This design should not be used because of its cost and the difficulties in welding, as well as the lower joint strength.

Due regard must be given to penetration and to the shape of the joint, particularly the reinforcement of the weld. This is more important in the larger than in the smaller pipe sizes. Butt welds should be reinforced at least 25 per cent and should be so built up as to present a gradual increase in the

reinforcement from the pipe wall to the center of the weld. Fillet welds, when used, should be built up well in excess of the wall thickness of the bell.

There is no detrimental heat effect or structural weakening of the pipe metal due to welding.

The uniformly high strength obtained in these numerous joint tests indicates the dependability of properly made welds. With qualified welders under proper control methods, a pipe joint of maximum efficiency can be consistently and uniformly made by the oxyacetylene process.

Evaporating, condensing, and cooling apparatus, E. HAUSBRAND, trans. by A. C. WRIGHT, rev. by B. HEASTIE (*London: Ernest Benn, 1929 4. Eng. ed., rev. and enl., pp. XXI+23-468, figs. 40*).—This is the fourth English edition of a book translated by A. C. Wright from the second revised German edition.

It contains chapters on the coefficient of transmission of heat, k , and the mean temperature difference, Θ_m ; parallel and opposite currents; apparatus for heating with direct fire; the injection of saturated steam; superheated steam; evaporation by means of hot liquids; the transference of heat in general and transference by means of saturated steam in particular; the transference of heat from saturated steam in pipes (coils) and double bottoms; evaporation in a vacuum; the multiple effect evaporator; multiple effect evaporators, in which steam ("extra steam") is taken from the first and following vessels for other purposes than to heat the next vessel; the weight of water which must be evaporated from 100 kg. of liquor in order to bring its original percentage of solids r_1 up to the desired higher percentage r_2 ; the relative proportions of the heating surfaces in the elements of the multiple evaporator and their real dimensions; the pressure exerted upon floating drops of water by currents of steam and air; the motion of floating drops of water, upon which press currents of steam; the splashing of evaporating liquids; the flow of liquids, vapors, and gases through pipes; the diameter of water pipes; the loss of heat from apparatus and pipes to the surrounding air and means for preventing the escape; condensers; heating liquids by means of steam; the cooling of liquids; the volumes to be exhausted from condensers by the air pumps; a few remarks on air pumps and the vacua they produce; the volumetric efficiency of air pumps; determination of the volume of air, V_1 , which must be exhausted from a vessel containing the volume V , at the pressure p_a , in order to reach the lower pressure, p_1 ; and some modern types of evaporating plant.

Strength tests of knots, hitches, and splices, J. G. DENT (*Agr. Engin., 10 (1929), No. 8, pp. 261. 262, figs. 3*).—The results of tests at the Minnesota Experiment Station are reported. An eye splice was used in the tests to secure the ends of the rope over a $\frac{3}{4}$ -in. gas pipe. Approximately 90 per cent of the breaks in the unspliced rope were in the straight part near or at the end of the splicing which formed the eye. This would indicate that the spliced eye weakens the rope slightly, although less than any other form of fastening. In the spliced eye the strands of the rope are spread slightly by the loose ends being wrapped around them, probably throwing a slightly greater strain there and causing the rope to fail at that point.

In about 90 per cent of the specimens one strand broke first. When a knot was tied in the rope the failure was always at the knot, usually one strand first. The break does not occur in the bend of the rope within the body of the knot, but in the straight rope at one end of the knot where it is encircled and sheared off by the part forming the knot.

The longest piece of fiber found in the 4-strand rope was 7 ft. The average length of 300 fibers was about 3.5 ft. In the 3-strand rope, the longest fiber measured 6 ft. and the average length was 3 ft.

Anti-friction bearings in farm equipment, L. M. KLINEDINST (*Agr. Engin.*, 10 (1929), No. 7, pp. 221-224, figs. 11).—A description is given of the use of roller bearings in mechanical farm equipment such as disk plows, threshers, combines, silage cutters, feed grinders, and windmills.

Producing corn and soybeans with mechanical power, C. L. OSTERBERGER (*Agr. Engin.*, 10 (1929), No. 6, pp. 201, 202, figs. 2).—A progress report of studies at the Louisiana Experiment Stations is presented. The object of the study was to determine the practicability and economy of tractors and tractor equipment in producing corn and soybeans on the alluvial or bottom lands of Louisiana. The rainfall over this area averages 60 in. annually, and drainage is difficult because of the low-lying nature of the land and lack of suitable outlets. For this reason fields are a network of open ditches and drains. Laterals range from 50 to 200 ft. apart and quarter drains are plowed across each "cut," usually at right angles to the rows, to permit the surface water to reach the ditches.

The opinion is expressed that general-purpose tractors will never produce crops on alluvial lands exclusively, where open ditches and quarter drains exist. These ditches and drains affect seriously the rate of work.

It appears probable that rows wider than 3.5 ft. will be necessary, in order to secure enough ridge to get the roots of corn and beans up into aerated soil because of lack of drainage, which is a limiting factor in crop production on alluvial soils. This will mean a redesigning of existing cultivators and 2-row lister outfits. A rigid 2-row cultivator with shovels behind the tractor wheels seems to be most satisfactory on the heavier bottom soils.

It was possible for 1 negro to handle the plowing, disking, bedding, and cultivating of a 60-acre field. This acreage normally would require 3 men and 6 mules as a minimum and 4 men and 8 mules as a maximum where 6-ft. rows are used.

Regardless of whether there is any saving in power, there is apparently a saving in labor of from 50 to 75 per cent when these results are compared with labor requirements throughout the alluvial section.

Crops were produced exclusively with the tractor except for plowing ditch banks and quarter drains. Corn was laid by when 3.5 to 4 ft. high.

There still seems to be room for improvement of tractor equipment suited to these needs, especially planters and cultivators.

Report of trials of the combine harvester-thresher in Wiltshire, 1928, J. E. NEWMAN and J. H. BLACKBAY (*Univ. Oxford. Inst. Research Agr. Engin. Bul.* 3 (1929), pp. 50, pls. 9, figs. 5).—The results of trials of a combine are reported. It was found that the use of the combine will reduce the cost of harvesting by nearly 50 per cent, and more if the straw is plowed in or burned. The combine is as handy in small fields as a binder and cuts squarer corners. It is too wide, however, to get through ordinary gates. The machines now available are, owing to their cost and the difficulty of transport, not suitable for small farms or for contractors.

The conclusion is drawn that the combine is a practical means of harvesting grain in England. The climate is not a bar to its use, and its adoption should be seriously considered by large grain growers. Where straw is required for sale and is an important part of the crop, the use of the combine can not be recommended. Means of drying the grain must be regarded as a necessary part of the combine harvesting plant. The development of a grain drier is described, and specifications for the combine used are appended.

An appendix reports studies by J. H. Blackbay on the moisture content of wheat and barley and weather conditions during harvesting. The results indicate that cutting can be deferred only until the grain is dry enough to

thresh, and that subsequent drying must be regarded as normally necessary. It was found that the straw takes up moisture more readily than the grain, and that, while dampness of straw caused more trouble in the threshing drum than weeds, the latter interfered considerably with the cleaning mechanism. Another appendix gives data on the germination of combined and artificially dried grain.

Drying alfalfa hay by forced draft with heated air. W. M. HURST and T. A. KIESSELBACH (*Agr. Engin.*, 10 (1929), No. 7, pp. 218-220, figs. 2).—The results of studies by the Nebraska Experiment Station in cooperation with the U. S. D. A. Bureaus of Public Roads and Plant Industry are reported.

It was found that the hay dried much faster with air at 160° F. than at either 140 or 120°. The rate of drying at a given temperature is also shown to depend in part upon the velocity of the drying air entering the hay.

About 7,800 B. t. u. were required per pound of dry hay for the test showing the lowest total heat requirement. At this rate about 0.56 lb. of coal with a heat value of 14,000 B. t. u. would have been required per pound of dry hay assuming that no heat was lost from the products of combustion. On this basis the equivalent of 1,120 lbs. of coal would have been required per ton (2,000 lbs.) of dry hay. The efficiency of the drier could doubtless be increased by recirculating the drying air, but the efficiency of the coal or coke burning furnace suitable for drying hay would be considerably less than 100 per cent.

Very choice hay was produced by all combinations of the artificial drying. The commercial grade averaged "No. 1 Extra Leafy" alfalfa, which is the highest Federal grade. The color and odor were choice, the stems were soft and pliable, and the protein content averaged 20.4 per cent. The extreme range in protein was from 19.4 to 21.6 per cent. The variation may be due in part to field variability and in part to advancing maturity as the experiment progressed.

The field-cured hay graded equally good, and its description was as favorable except for 7 per cent inferior color and 1 per cent lower protein content. These slight shortcomings were doubtless caused by sun bleaching and leaf shattering. All of the leaves could be retained by the artificial drying method. Such drying resulted in only 0.4 per cent lower protein than was obtained under the experimental conditions of slow shade curing in the hay barn where no leaves were lost. This difference would seem to be within the limits of experimental error.

It is concluded that the principle of rapid control drying in no way increases the actual protein content over that of the fresh forage as has sometimes been suggested; but, on the other hand, no protein is lost through waste of leaves as may occur in varying degrees under field-curing conditions. There is no reason to suspect a modification of either the palatability or nutritive value of the forage produced by rapid curing at the range of temperature herein used as compared with natural curing under favorable field conditions except that associated with loss of leaves. The field-curing condition must, on the other hand, be exceptionally favorable to produce equally choice hay.

The spontaneous combustion of hay. C. A. BROWNE (*U. S. Dept. Agr., Tech. Bul.* 141 (1929), pp. 39, figs. 8).—This bulletin contains a review of previous theories as to the cause of the spontaneous combustion of hay, indicating a wide divergence of opinions, and gives new suggestions in an effort to develop a tenable theory based on experiments by this Department and other agencies.

The theory of the spontaneous heating and ignition of large masses of hay proposed is based upon the preliminary production by microorganisms under more or less perfect anaerobic conditions of unsaturated, highly unstable, inter-

mediate-fermentation products upon the surfaces of the porous, cellular materials. The duration of existence of these readily oxidizable fermentation products is dependent upon the quantity of air that can gain access to the fermenting mass of hay, and also upon the quantity of moisture which is present to serve as a reacting medium. If the heaps are small or of open, loose structure, the intermediary compounds are destroyed almost as soon as formed, with the result that when vegetative microorganic life is all destroyed at 70 to 80° C. (158 to 176° F.), there is not a sufficient residue of such easily oxidizable, unsaturated substances to carry the production of heat to higher limits. The heat of the microbial life period is probably owing in large part to the oxidation of the same intermediary unstable products that participate in the elevation of temperature above 80°. The microorganisms simply produce the highly unstable compounds whose subsequent oxidation generates the increasing quantities of heat that lead first to the destruction of the organisms themselves and then eventually to the ignition of the hay.

It has been found possible to duplicate in the laboratory some of the conditions existing in a hay pile for the formation of such unsaturated compounds, and, by adopting suitable means for preventing access of oxygen, to effect their separation and identification.

In pointing out the need for further investigations in the subject it is stated that "the answer to the problem can be obtained only by extensive cooperative experiments by chemists, bacteriologists, and engineers upon the changes that take place in large piles of fermenting hay. The piles must be sufficiently large (5 tons or more) to furnish the retention of heat and insulation that are necessary to produce spontaneous ignition of the hay.

"In observing the changes that take place in large piles of fermenting hay, and developing methods for the prevention of spontaneous heating and ignition, investigators must give special attention to the following factors: The rate of heat production in different parts of the mass of material; the changes in chemical composition of the hay; the oxygen-consuming power of fresh and fermented hay and of extracts from the same; the migration of moisture from the warmer to the cooler parts of the stack; the production of gases in different parts of the pile; the effect of the entrance of outside air at various stages of storage upon producing an increase of temperature in different parts of the pile; a study of the conditions existing in the areas of highest heat production; the effect of various methods of curing the hay; the effect of the addition to the hay of salt and other substances; the employment of ventilating flues and other devices."

A bibliography is included.

A study of farm house costs, D. G. CARTER (*Agr. Engin.*, 10 (1929), No. 6, pp. 203, 204, figs. 2).—The progress results of studies at the Arkansas Experiment Station are reported. The houses studied included 2-, 4-, 5-, 6-, and 7-room structures.

The results indicate that the minimum cost for 2- to 4-room houses of fair construction without basement or utilities is almost 12 cts. per cubic foot. Normally the 1-story modern house, with basement, warm air heat, complete utilities, and frame construction, in the 5-room size will cost above 17 cts. per cubic foot in Arkansas. The cost for 2-story houses of 6 rooms with characteristics similar to 1-story modern types would be about 21 1/2 cts. per cubic foot. The average cost of the completely modern, 2-story, 6-room house with asbestos roof, brick veneer, and steam heat would be 25 cts. a cubic foot.

Other factors being equal, the larger the volume, the lower the cost per cubic foot. One-story houses, with basement, cost less per cubic foot of total volume

due to the larger portion of basement space in the total. There is no significant difference in the cost of the finished space in 1- and 2-story houses, as determined from a limited number of cases.

The cost per square foot of ground area is approximately 15 times the cubic unit cost in the case of plain cottages, 21.5 times the cubic unit cost in the 1-story modern house with basement, and 30.5 times the unit cost in the 2-story completely modern houses.

RURAL ECONOMICS AND SOCIOLOGY

Large-scale farming, W. H. DEAN and J. B. BENNETT (*Washington: Chamber Com. U. S., Agr. Serv. Dept., 1929, pp. [4]+37*).—This multigraphed publication analyzes the data from 74 farms obtained by sending out a questionnaire in 1928. The farms varied in size from 84 to 300,000 acres, averaging 11,797 acres.

A table is included showing by years, 1918–1924, and the average for the period for cotton, grain, fruit, stock, and general farming the number of corporations engaged in farming, and the number reporting net income and no net income, the total net income or net deficit, and the averages per farm. The table also gives similar data for total farming for the same period and for the year 1926. Another table shows for each of the 74 farms the form of organization, years in business, acreage owned and rented, capitalization, acreage in crops, principal crops, number of livestock by kinds, farm power by kinds, investment in farm machinery, number of units in farm, how the farm was managed and operated, salaries of managers, number of laborers in different seasons and wage scales, and gross income, expenses, and net income by years, 1925–1928.

The income tax returns of corporation farms and all classes of farms are compared. The data in the tables covering the 74 farms are summarized, and the advantages and disadvantages of large farms, the future of large-scale farming, and alternative forms of agricultural organization are discussed.

Systems of farming for the Purchase Region of Kentucky, J. B. HUTTON, W. G. FINE, and Z. L. GALLOWAY (*Kentucky Sta. Bul. 293 (1929), pp. 25–154, figs. 15*).—This bulletin is the second of a series based on the farm management study previously noted (*E. S. R., 61, p. 782*). Actual systems typical of those followed on a large number of farms and suggested systems combining the strong points of the more profitable of the actual systems are presented for farms of 60, 80, 100, 150, 200, and 300 acres. The weaknesses of the actual systems are pointed out, and the conditions to which the suggested systems are applicable are described.

Income from crop and pasture land, E. G. MISNER (*Jour. Amer. Soc. Agron., 21 (1929), No. 6, pp. 594–603*).—Data are presented as to the cost of maintaining, and the income from, pasture lands in New York in 1915, 1919, and 1922–1927; tame grass pastures in Minnesota in 1907, pasture lands in North Dakota in 1923 and 1924, and in England in 1919; the cost of maintaining, and the income from, crop land in New York in 1923–1927; and the rate of application and value of manure applied to different crops on dairy farms in Chenango County, N. Y., 1921–1925.

The beet-sugar industry in Colorado and in the United States (*Univ. Denver Business Rev., 5 (1929), No. 3, pp. 1–7, figs. 3*).—This publication summarizes the subject matter and gives the conclusions of a study made by J. R. Wood, jr., and presented in full in a thesis entitled *A Study of the Beet Sugar Industry in Colorado and in the United States*, submitted to the School of

Commerce, Accounts, and Finance, University of Denver, and filed in the library of that school.

Tables and graphs are included showing by States the beet-sugar production, 1911-1928: average yield and sugar production per acre and percentage of sucrose by years, 1915-1928, and for the period 1924-1928; percentage of sucrose in beets minus quantity recovered by States and the United States, 1905-1928; average prices by years, 1913-1928, of granulated sugar (retail) in the United States and of raw sugar (wholesale) in New York City; beet-sugar production, 1926-1928, in important foreign countries; number of beet-sugar factories in the United States and their total production of beet sugar, 1909-1928; production of cane sugar in the United States, 1908-1928; acreage of sugar beets harvested, by counties, in Colorado, 1922-1928; per capita sugar consumption in the United States and the percentage the United States consumption was of the world production, 1883-1928; sources of United States sugar supply, 1904-1928; and number employed, salaries and wages paid, and value of beet sugar produced in Colorado, Utah, California, Michigan, and the United States, 1923 and 1925.

Other tables show the changes in sucrose percentage of beets in northeastern Colorado corresponding to changes of 1° F. in temperature, 1 in. in precipitation, and 1 per cent of sunshine in each of the months of June, July, August, and September, and the correlation of sucrose percentage with mean temperature and with precipitation in June, June and July, June to August, and June to September, inclusive. Correlations of the average sugar content of northeastern Colorado sugar beets for the years 1905-1928 with the mean temperatures and precipitations gave coefficients as follows: June, +0.266 and —; June-July, +0.248 and +0.181; June-August, +0.288 and +0.316; and June-September, +0.362 and +0.321. The coefficients for the amount of sunshine, June to September, and the number of days from August 1 to the first killing frost were +0.247 and 0.128, respectively.

The strawberry industry in the United States: A selected list of references on the economic aspects of the industry, compiled by E. M. COLVIN (*U. S. Dept. Agr., Bur. Agr. Econ., Agr. Econ. Bibliog.* 23 (1929), pp. II-52).—A mimeographed selected bibliography of books, bulletins, and pamphlets on the economic aspects of the strawberry industry.

Walnut supply and price situation, H. E. ERDMAN and W. U. FUHEIMAN (*California Sta. Bul.* 475 (1929), pp. 60, figs. 15).—Tables and graphs present and analyze data regarding the number of bearing and nonbearing walnut trees and walnut production in the United States, acreage of bearing and nonbearing trees and plantings and production in California by years, acreage and production by counties in California, walnut production in foreign countries, international trade in walnuts, imports into the United States, consumption in the United States, and prices of California nuts.

The study shows that production in California has increased about 6.5 per cent per year since 1895, and that in 1929 31 per cent of the acreage was not yet in bearing and probably not over 40 per cent was in full bearing.

[Surveys of grazing areas in Alaska], H. W. ALBERTS (*Alaska Stat. Rpt.* 1928, pp. 26-31, figs. 2).—Data are given regarding the topography, climate, population, vegetation, livestock, feed, transportation facilities, and the grazing possibilities of the Aleutian Islands and vicinity and the bunch grass area at Healy and Lignite on the north slope of the Alaska Range.

An economic study of livestock possibilities in the southeastern Coastal Plain, R. D. JENNINGS and M. A. CROSBY (*U. S. Dept. Agr., Tech. Bul.* 127 (1929), pp. 96, figs. 24).—This bulletin presents the results of a study made in cooperation with the Alabama Extension Service, the Georgia State College

of Agriculture, and the State experiment stations of Mississippi and South Carolina. It is based upon records of the details of feeds and pastures used, costs, and incomes obtained from a survey made in 1926 of about 700 farmers; records of experimental work in the States; consultations with county agents, bankers, and others interested in agriculture in the area; and a survey of the marketing, consumption, and source of supply of the livestock products in the principal consuming centers of the area.

Pastures and feed crops as a basis for livestock production; the agricultural divisions of the area; the present status and possibilities of dairying and of hog, beef cattle, sheep, and poultry production in the different sections of the area; and livestock production as a part of farm organizations in the different divisions of the Coastal Plain area are described and discussed.

A report of the convention for the revision of Oregon's dairy program (*Oreg. Agr. Col. Ext. Bul.* 413 (1929), pp. 32, fig. 1).—Included are reports of the committees on economic status of the dairy industry; marketing, grades, and standards; dairy financing; production and management; and disease control, adopted by the convention at Corvallis, March 21 and 22, 1929.

Distribution of live stock in Scotland, R. GERRIE and J. S. KING (*Scot. Jour. Agr.*, 12 (1929), No. 3, pp. 235-251).—The changes in the livestock industry in the past 50 years in different sections of Scotland are discussed.

Notes presented to the second meeting of the economic consultative committee of the League of Nations (*Rome: Internatl. Inst. Agr.*, 1929, pp. 96; *App. 1*, pp. IV+112; 2, pp. 42; 3, pp. VIII+175).—Part 1 (pp. 7-85) deals with the production and the price movements of agricultural produce; certain distinctive aspects of the economic position of the agriculturists, particularly as regards credit and cooperation; the progress in agricultural methods; the tendencies of agricultural legislation; and the tendencies and special activities of agricultural associations during 1928 and the early part of 1929. Part 2 (pp. 86-96) describes the work of the International Institute of Agriculture in agricultural credit, control of plant diseases, and agricultural documentation so far as it bears on the resolutions of the World Economic Conference at Geneva.

Annexed are brochures in French as follows: Documents Relating to International Agricultural Credit, Documentation for the International Diplomatic Conference for Plant Protection (Rome, April 10-16, 1929), and The Legislation on the Trade in Plants in the Different Countries.

Recent acts of Parliament (*Scot. Jour. Agr.*, 12 (1929), No. 3, pp. 262-266).—Brief synopses are given of the Agricultural Produce Act, 1928; Agricultural Credits (Scotland) Act, 1929; Local Government (Scotland) Act, 1929; and Artificial Cream Act, 1929.

What about the year 2000? ([Washington, D. C.: *Fed. Soc. on Planning and Parks*, 1929], pp. XV+168, pls. 4, figs. 12).—This study was made under the direction of the Joint Committee on Bases of Sound Land Policy with a view to determining whether the land area of the United States will meet the demands of the future population, and how the land resources can be best used.

The agrarian reform in Hungary and the financial solution of the problems (*La Réforme Agraire en Hongrie et la Solution Financière de ses Problèmes*. Budapest: Conféd. Natl. Hongroise du "Village," 1929, pp. 23).—The agrarian reform legislation and its operation and results are described.

Social aspects of agrarian reform in Latvia, F. W. v. BÜLOW (*Internatl. Labor Off. [Geneva], Internatl. Labor Rec.*, 20 (1929), No. 1, pp. 35-66).—The effects of the agrarian reform acts passed from 1920 to 1923 on land holdings, agriculture, and agricultural labor are discussed.

The Privileged Agrarian Bank Act (*Belgrade Econ. Rev.*, 4 (1929), Nos. 5, pp. 105, 106; 6, pp. 130-135).—A brief analysis of the law of April 16, 1929, of the Kingdom of the Serbs, Croats, and Slovenes is given in the first article by M. Nedeljković. The second article gives a synopsis of the act by sections.

The dairy industry as a basis for colonisation in Palestine, I. ELAZARI-VOLCANI and A. SUSSMANN (*Bul. Palestine Econ. Soc.*, 3 (1928), No. 2, pp. XII+205).—This is an economic study of the status of dairy stock and forage crops, sources of the dairy supply, costs of milk production, the marketing of milk, the capacity of the internal market, factors operating in milk production, and the necessary steps in transferring to dairying in Palestine. The international dairy market and the status of the dairy industry in the leading exporting countries are discussed.

Cooperation in the Latin countries, C. GIDE (*La Coopération dans les Pays Latins*. Paris: Assoc. Ense. g. Coopération, [1928], pp. 286).—The development and present status of cooperative producers', consumers', credit, and other agricultural organizations in Italy, Spain, Portugal, Rumania, Greece, Mexico, Argentina, and other South American countries are described.

Union County home markets survey, L. R. BREITHAUP and R. M. HALEY (*Oreg. Agr. Col. Ext. Bul.* 411 (1929), pp. 94, figs. 55).—Graphs and tables are given showing by months for 1928 the price, consumption, and supply from outside sources of different fruits, vegetables, poultry products, dairy products, meats, cereal products, and honey. The general market condition, the markets and facilities of Union County, and the feasibility of establishing a farmers' market are discussed.

Survey of the wheat situation, M. K. BENNETT ET AL. (*Wheat Studies, Food Research Inst. [Stanford Univ.]*, 5 (1929), Nos. 6, pp. [1]+207-240, figs. 5; 10, pp. [1]+427-465, figs. 7).—In continuation of the survey previously noted (*E. S. R.*, 61, p. 239), the first of these publications, covering the period December, 1928, to April, 1929, discusses supply and demand for the crop year, international trade, visible supplies and other stocks, wheat price movements, prospects for 1929 crops, and the outlook for trade, prices, and carry-overs. The second, covering the period April to July, 1929, deals with the new crop developments, visible supplies and outward carry-overs, wheat price movements, international trade, and the outlook for the new crop year.

Variations in wheat prices, A. E. TAYLOR ET AL. (*Wheat Studies, Food Research Inst. [Stanford Univ.]*, 5 (1929), No. 7, pp. [1]+241-300, figs. 5).—This is an analysis and appraisal of the variations in wheat prices, July, 1899, to June, 1914, inclusive, and July, 1921, to June, 1928, inclusive, "without pretension to exhaustive treatment in compilation or mathematical interpretation of data." The variability of wheat prices is contrasted with that of other commodities, and the nature of the price quotations employed is discussed.

Tables and graphs are included showing the interseasonal variations in prices, the recurring seasonal movements, and the irregular variations extending over weeks and months. The extent and amplitude of, and the causal influences affecting, such variations are discussed. Brief consideration is also given to the variability of farm prices of wheat and to a comparison of prewar with postwar variability.

North Dakota potato grade inspection service, E. M. GILLIS and R. C. HASTINGS (*North Dakota Sta. Circ.* 38 (1929), pp. 8).—The rules and regulations established under the provisions of chapter 186 of the North Dakota session laws of 1929, information regarding the use of the inspection service, and suggestions to growers, dealers, and warehouse men are included.

Marketing fresh fruit in Europe, E. SMITH (*U. S. Dept. Agr. Circ. 90* (1929), pp. 120, figs. 23).—The export trade in the leading countries of Europe in apples, oranges, grapefruit, pears, prunes, and other fruits and vegetables; the demand and competition; marketing practices; and the distribution systems in the leading markets are discussed. Suggestions are made as to packing and refrigerating for, and meeting specialized demands, etc., of the European trade. Recommendations to the small grower, large shipper, cooperative exchange, and export agents are included.

[Marketing of home-grown wool] (*Jour. Min. Agr. [Gr. Brit.], 36* (1929), No. 3, pp. 272–282).—The report and recommendations of the standing committee of the Council of Agriculture for England, adopted by the council May 9, 1929.

Losses in shipping Ohio livestock, G. F. HENNING (*Ohio Sta. Bul. 438* (1929), pp. 80, figs. 11).—Data were obtained from the Cleveland Union Stockyards Company regarding weight of car, origin of shipment, number of head, and number of crippled and dead animals per car of cattle, calves, hogs, and sheep received during the year ended September 30, 1927, and by random sampling by an observer, which included 13.2 per cent of the single-deck and 14.9 per cent of the double-deck cars arriving.

Tables and graphs are included showing usually for each kind of livestock the number received, number and value of crippled and dead animals in railroad and truck shipments, yard losses, number of crippled and dead animals by States and Ohio counties of origin, variations in losses by months, 1924–1927, and losses in straight and mixed cars. Other tables and graphs show the effects of the following factors on losses: Single and double deck cars, unpartitioned cars and cars partitioned in different ways, straight and mixed carloads, marketing agencies, time in transit, transferring of cars, size of cars, number of hogs per car, temperature, footing in cars, kind and condition of bedding, showering, feeding hogs in transit, cleanness of cars, grades of hogs, and inclusion of stags and roughs in hog shipments.

Of the 7,604 single-deck and 2,688 double-deck cars, there were losses in 2,463 cars. The numbers of dead animals per 10,000 arriving by railroad and by truck and in the yards, respectively, were for cattle 4.2, 3.2, and 0; calves 12, 0.4, and 0; hogs 20.5, 8.9, and 1.9; and sheep 31.5, 7.4, and 0. The numbers crippled per 10,000 were for cattle 6.8, 0, and 0; calves 4.6, 0, and 0; hogs 42.5, 0, and 57.8; and sheep 9.1, 0.1, and 0. The cripple and death losses averaged \$4.15 per car shipped by railroad. For cars from Ohio having losses, the losses were under \$4.99 in 27.3 per cent, from \$5 to \$9.99 in 28.1 per cent, from \$10 to \$24.99 in 26.9 per cent, and from \$25 to \$49.99 in 11.5 per cent.

The death and cripple losses on the average were higher for calves, hogs, and sheep in single-deck cars, and for hogs and sheep in partitioned cars. Death losses for hogs and sheep were considerably higher in mixed loads in both single and double deck cars. Cars loaded by cooperative associations had higher death losses for calves, hogs, and sheep, and lower cripple losses for cattle, calves, and hogs, than cars shipped by dealers.

Most of the crippling occurred within the first 20 hours in transit. In the summer the longer hogs were in transit, the higher the death loss. The death loss of hogs was considerably higher in cars that were transferred from one railroad to another. Medium loaded cars had smallest losses, the cripple loss being higher in light loaded cars and the death loss in heavy loaded cars. Only hog losses were affected appreciably by temperature, the death loss being highest in extremely cold weather, lowest when the temperature was from 30 to 50° F., and increasing with warmer temperature. On the

average, straw was the best bedding for cool and cold weather and sand for warm and hot weather. Showering reduced hog losses, but the losses were very low in sand-bedded cars without showering. Feeding hogs in transit affected losses very little during the winter, but increased losses during the summer. Hog losses were higher in uncleaned cars. Death loss of hogs was highest among heavy and mixed grades, and the cripple loss highest among the heavy and medium grades. Shipment of roughs and stags in cars affected hog losses very little.

Interpretation of the data and the factors affecting losses are included.

The truck and its relationship to livestock marketing in Ohio, G. F. HERNING (*Ohio Sta. Bul.* 440 (1929), pp. 45, figs. 8).—The data upon which this bulletin is based were obtained from the records of the terminal stockyards at Cleveland and Cincinnati, the Highway Department of Ohio, and the U. S. D. A. Bureau of Agricultural Economics, county agents, managers of livestock-marketing agencies, personal interviews, and 398 questionnaires returned by farmers in 70 townships in southwestern Ohio.

Tables and graphs are included showing the number of cattle, calves, hogs, and sheep received by truck at Cleveland, Cincinnati, Buffalo, Chicago, East St. Louis, Indianapolis, and Pittsburgh each year for a period of years; the number and percentage of each kind of livestock trucked to Cleveland and Cincinnati by 10-mile zones in 1922, 1927, and 1928; and the number of different kinds of livestock sold and trucked by the farmers returning questionnaires in southwestern Ohio.

Other tables give data as to types of roads, truck registrations, railroad rates, trucking and yarding charges on livestock, size of trucks serving livestock farmers in southwestern Ohio, reasons given for trucking, shrinkage of trucked hogs, places of disposal of livestock trucked by the farmers in southwestern Ohio, and the number and percentage of livestock shipped by three railroads from 30 points in southwestern Ohio in 1923 and 1928.

The study of the two Ohio markets shows that both moving livestock from the farm and transporting it to terminal markets by truck have increased greatly within the last few years; that the great percentage of truck receipts at both markets originated between 20 and 60 miles, but the numbers received from the 50- to 70-mile zones have shown exceptional growth; and that the marketing units being evolved are tending to concentrate around points depending upon the volume of livestock that can be secured within a radius of 10 to 20 miles.

Origin, development, and practices of livestock insurance, E. W. KOFF (*Casualty Actuarial Soc. Proc.*, 14 (1928), pt. 2, pp. 291-372).—A review of the development and present status of livestock insurance in the United States, England, Germany, France, Sweden, and other countries of Europe and the world.

A bibliography is included.

Rural sociology, A. W. HAYES (*New York and London: Longmans, Green & Co.*, 1929, pp. VIII+598, figs. 25).—A college textbook in the general field of rural sociology in which the aim is "to present rural social life not as a separate and distinct entity apart from the larger social life of State and Nation but as a vital part of society."

Included are chapters on the meaning, scope, and methods of rural sociology; social and historical backgrounds; historical and comparative rural life in America; the rural population; economic factors; psychological factors; political and governmental factors; town and country relationships; the rural community and its organization; the rural family and home; and rural standards of life, socialization, leadership, organizations, education (schools, extension,

and adult), religion, social pathology and social service, health and public health service, art and recreation, and policies and principles of balance.

Social research: A study in methods of gathering data, G. A. LUNDBERG (New York and London: Longmans, Green & Co., 1929, pp. XI+380, figs. 15).—The volume "is devoted to the advocacy of the fuller employment of the method of natural science in social adjustments, and to a consideration of some of the more fundamental conditions and difficulties attaching to the application of this method to social phenomena," and deals chiefly with "consideration of methods of collecting social data in such form that they will be amenable to scientific generalization."

Chapters are included on prospects of social science; the difficulties of objective observation of social phenomena; terminology, units, and classification; the principal methods of social research; the sample in social research; the schedule as an instrument of observation; field work—the interview and social survey; case studies and the statistical method; the measurement of attitudes; the measurement of social institutions; and the standardization of social statistics.

Appendixes give selected references on each chapter, published sources of social data, and a list of types of social measuring devices.

Rural population, Tompkins and Schuyler Counties, New York, 1925, B. L. MELVIN (New York Cornell Sta. Bul. 487 (1929), pp. 58, figs. 19).—Data obtained in the 1925 State census of New York are analyzed. Tables and graphs are presented showing for each county and for the two counties combined the distribution of the population in incorporated villages, unincorporated villages, institutions, and open country; distribution of open-country population between farming and nonfarming; density of rural, open-country, and farm population; foreign population; distribution by sex and age of the rural, incorporated-village, unincorporated-village, and open-country population; the occupations of males and females 15 years of age or over, by age groups; number of widows and widowers; and the size of families. Other tables and graphs show the distribution of the population by age groups in Watkins Glen (a tourist town) and in a number of villages in agricultural areas, in areas of farm abandonment, in townships in the open country, in industrial villages, and in territory contiguous to Ithaca.

Of the rural population of the two counties, 60.7 per cent was in the open country, 23 per cent in incorporated villages, 15 per cent in unincorporated villages, and 1.2 per cent in institutions. Thirty-one per cent of the open-country population was nonfarming.

The following table shows the ratio of females to males, average age of population, percentage of population in, above, and below the productive age groups, and the average size of family for the different types of population:

Table showing ratio of females to males, average age of population, percentage of population in different age groups, and average size of family for the different population groups

	Total rural population	Open country	Incorporated villages	Unincorporated villages
Ratio of females to males.....per cent.....	93.6	89.5	108.5	95.2
Average age.....years.....	33.6	32.2	36.2	34.8
Population under 15 years of age.....per cent.....	27.6	30.1	22.0	26.5
Population 15 to 49 years of age.....do.....	45.3	44.5	48.4	44.4
Population 50 years of age and above.....do.....	26.9	25.2	29.5	28.9
Average size of family.....persons.....	3.0	3.2	2.7	2.9

Of the gainfully employed males 15 years of age or older, 29.4 and 16.5 per cent, respectively, of the total rural population and 41.7 and 22.1 per cent, respectively, of the open-country population were farm operators and farm laborers. Cities, towns, and villages were found to influence density of the open-country population more than the type of farming. Farm operators were found to be largely over 34 years of age. The trade of the villagers was found to be controlled by men over 34 years of age, and most of the men engaged in transportation were below 45 years of age.

Rural depopulation in certain Tidewater and Piedmont areas of Virginia, W. GEE and J. J. COBSON. 3d (Va. Univ., *Inst. Research in Social Sci., Inst. Monog.* 3 (1929), pp. X+104, figs. 2).—The data for this study were secured from 209 white and 143 colored families, including 1,910 white and 1,466 colored individuals, in 10 counties of Virginia. The individuals represented three generations and the different social levels of the counties. The area and the problem are described, and the social origins, present residence, and occupations of the permanent and temporary migrants; the composition, education, and occupations of the nonmigrants; and the birth and death rates, wealth values, and institutional life of the area are discussed.

The rôle of the church in rural community life in Virginia, C. H. HAMILTON and W. E. GARNETT (*Virginia Sta. Bul.* 267 (1929). pp. 191, figs. 62).—This regional study of the rural church is based on an analysis of unpublished material of the U. S. Census of Religious Bodies, 1926, denominational reports, results of numerous questionnaires, and data gathered by workers in a six months' field study.

Tables, graphs, and maps of Virginia (by counties) are given showing the extent and distribution of church and Sunday school membership (white and negro, urban and rural); the relation of church membership and density of population, distribution of churches, distribution of ministers, social stratification, percentage of population on farms, farm tenantry, and other factors; the size and distribution of rural churches and the factors affecting size and distribution; and the expenditures per church and per member, relation of farm wealth and income to church expenditures, value of church buildings, and home mission aid. The aims and methods of religious education are discussed.

Included is a copy of a religious education and attitude test administered to approximately 1,200 high-school and 800 college students and including a personal data questionnaire; a statement as to membership in, and attendance of, organizations and opinion of the value of the organizations; a biblical information test; an ethical discrimination test; and a rural life problems test. Tables are given and discussed showing the scores in the biblical and ethical tests made by white and negro high school and college students, totaled and classified by income of parents, education of father and of mother, occupation of parents, regularity of church attendance by parents, religious group contact, and school attendance.

By 173 replies to questionnaires sent to leaders and presidents of young people's religious organizations it was shown that the average membership of such organizations was 41.8 and the average attendance 28, and that the percentage of membership living on farms was 46.6. The leadership was in the hands of the young people in 47 per cent of the organizations, of responsible adults in 38 per cent, of ministers in 9 per cent, and of local trained leaders in 13 per cent.

A questionnaire for scoring effectiveness of young people's religious organizations on the basis of 25 functions was filled in by approximately 350 white and negro college students, 33 rural sociologists, 21 members of the Virginia

rural church survey committee, and 18 church leaders. The 10 functions in which the organizations are most useful and efficient and the 10 in which they are least useful and efficient as shown by the scorings of each group are presented.

Attendance of young people at five types of religious or semireligious meetings was used as the basis of a religious organization contact index for the students covered by the statement of membership and attendance of organizations referred to above. Tables are included showing for the high school and college students (white and negro, male and female) the average contact indexes for the students grouped by the occupation, education, income, and regularity of church attendance of parents and by location of church. The obstacles to efficient young people's organizations in rural areas and the age, sex, and occupational distribution, and education and training of Sunday school teachers are discussed.

Maps, graphs, and tables are given and discussed showing the distribution, age, salaries, education, special training, reading interests, and available educational facilities of Virginia rural ministers, and also showing their attitudes and opinions regarding community improvement, the functions of the church, consolidation of churches, and the obstacles to efficient rural church work. The problems of rural Virginia are discussed, and tables and charts presented showing the average scoring made by 175 rural ministers, 200 rural Sunday school teachers, 20 church editors and leaders, 35 rural sociologists, 25 members of the Virginia rural church survey committee, 744 white college students, and 135 negro college students. The questionnaire used in scoring covered the degree of concern in churches in 25 matters of rural concern.

The church problems in typical rural communities of Virginia and of the negro rural church are described. The rural church policy in Virginia is summarized, and recommendations and suggestions are made for a rural church program for the State.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Objectives and problems of vocational education, edited by E. A. LEE (*New York and London: McGraw-Hill Book Co., 1928, pp. VIII+451, figs. 2*).—This symposium includes the following articles: The Ancestry of Vocational Education, by C. A. Bennett (pp. 1-18); Vocational Education as a National Responsibility, by J. C. Wright and C. R. Allen (pp. 19-44); Trends in Education for the Professions, by R. J. Leonard (pp. 45-67); Agricultural Education in Secondary Schools, by Z. M. Smith (pp. 69-94); Trends in Commercial Education, by E. W. Barnhart (pp. 95-128); Developments and Trends in Home Economics Education, by A. S. Baylor (pp. 129-152); Trends in Part-time Education, by R. L. Cooley (pp. 153-177); Trade and Industrial Education, by N. Ricciardi and B. W. Johnson (pp. 179-208); Vocational Teacher Training: Its Development and Present Trends, by R. H. Rodgers (pp. 209-262); Vocational Rehabilitation of the Disabled, by O. M. Sullivan (pp. 263-286); Trends in Vocational Guidance, by H. D. Kitson (pp. 287-310); Industrial Arts Education, by A. H. Edgerton (pp. 311-335); The Employer's Attitude toward Vocational Education, by J. P. Munroe (pp. 337-352); The Worker's Attitude toward Vocational Education, by J. J. Davis (pp. 353-366); Labor's Share in National Legislation for Vocational Education, by A. E. Holder (pp. 367-383); The Vocational Education Movement: A Critical Inventory of Policies, by D. Snedden (pp. 385-420); and A Forecast and Prophecy, by C. A. Prosser (pp. 421-446).

A method of determining courses of study in vocational agriculture based on an analysis of the business of selected farmers in Kentucky, F. G. BURD (*Fed. Bd. Vocat. Ed. Monog. 6* (1929), pp. V+22).—This monograph summarizes a study made "to arrive at principles, the application of which will enable teachers of vocational agriculture to make courses of study based on the practice of local farmers." The data obtained from 78 farmers selected because of their success are analyzed and interpreted, and 4-year skeleton courses in vocational agriculture are suggested for high school pupils whose major interest is farming in east-central or western Kentucky.

The folk high schools of Denmark and the development of a farming community, H. BESTRUP, H. LUND, and P. MANNICHE (*London: Oxford Univ. Press, Humphrey Milford; Copenhagen: Arnold Busck, 1929, 2. ed., pp. 176, pls. 4*).—This is the second edition of the work previously noted (*E. S. R.*, 36, p. 389).

Productive sheep husbandry, W. C. CORFEX, rev. by W. G. KANWLADE (*Philadelphia and London: J. P. Lippincott Co., 1929, 2. ed., rev., pp. XXXII+479, pl. 1, figs. 262*).—This is a revised edition of the textbook previously noted (*E. S. R.*, 41, p. 97). A job analysis of the operations in the sheep enterprise into 26 jobs has been added.

Introduction to agricultural economics, F. R. YONCE (*New York: Thomas Y. Crowell Co., 1929, pp. XIX+472, figs. 10*).—This is a textbook for an introductory course in agricultural economics. Realizing that many students in colleges of agriculture have little, if any, training in general economics, the author has made a special effort to make clear the elementary concepts of economics. The subject is treated in chapters on development of American agriculture and agricultural economics, the farm population and farm life, agriculture and the price economy, land as a factor in agricultural production, land income and land values, land tenure, land policies, social capital in farming, farm credit, insurance for the farmer, farm labor, farm management, marketing agricultural products, cooperative marketing, foreign markets, agriculture and the tariff, the farmer and taxation, agriculture and price movements, farmers' movements, and farm wealth and income.

Cooperative marketing of agricultural products, N. H. COMISH (*New York and London: D. Appleton & Co., 1929, pp. XXII+479*).—This volume is intended primarily as a basis for courses in cooperative marketing and a guide for managers and promoters of cooperative organizations.

Part 1 (pp. 1-246) deals with the history, purposes, present status, chief functions and problems, financing, etc., of the cooperative associations organized in the United States for selling the leading agricultural products and of cooperative purchasing associations. Part 2 (pp. 247-362) discusses the types of cooperative marketing association, the common difficulties facing cooperators, and the price, pooling, advertising, marketing cost, and legal problems of cooperative associations. Part 3 (pp. 363-439) describes the origin, nature, purposes, objectives, and activities of, and results accomplished by, the leading general farmers' organizations of the United States. Part 4 (pp. 441-462) discusses the principles of successful cooperative marketing and the progress of the movement.

FOODS—HUMAN NUTRITION

Nutritive value and cost of food served to college students, E. HAWLEY (*U. S. Dept. Agr. Circ. 89* (1929), pp. 20).—This circular deals with the food habits of college students as revealed by dietary studies previously reported by 12 investigators and hitherto unpublished studies made by the Office of

Home Economics in 1918, the Bureau of Home Economics in 1926, and L. W. Hunt at the State College of Washington in 1926. The new studies include 250, and the published studies 93 institutions. Reports from both supervised and un-supervised halls are included, all being obtained by the inventory method. The hitherto unpublished data were subjected to statistical analysis for reliability.

The similarity between the investigations made in the two periods was striking. As determined by coefficients of variation, energy was the least variable and calcium the most variable factor of the diet, with protein, phosphorus, and iron intermediate between these two factors. The variability figures agreed quite closely with those obtained by Sherman in his study of metabolism data for the purpose of setting nutritive standards of protein, calcium, and phosphorus.

As compared with the Sherman standards, the diets reported for the first time yielded slightly more energy, at least a third more protein, and from 7 to 26 per cent more calcium, phosphorus, and iron than were actually needed. As compared with the collected data from other investigations, the present studies showed somewhat less energy, protein, calcium, and iron, and about the same amount of phosphorus. Examination of the distribution of energy among the various food groups showed that on the whole meat, fish, eggs, fatty foods, and sweets were used in ample quantities, but that milk, cream, cheese, fruits, and vegetables played too small a part in the diet.

On the basis of 1926 price levels as determined by the retail food index numbers of the U. S. Bureau of Labor Statistics, the food in the institutions included in the studies made by the Office of Home Economics in 1918 and by Hunt cost on an average from 40 to 45 cts. per man per day. These figures are from 10 to 15 cts. less than the average for the colleges and universities studied by other investigators. Only one of the previous studies showed a smaller average expenditure, and the diet given there was inadequate in four essentials.

The diets planned by trained dietitians were more nearly adequate in every respect than those planned by persons untrained in food values.

Of value in planning menus and in purchasing food for a large group are two tables, one showing the average quantity of food consumed per adult male unit per month according to five investigations and the suggested average serving per adult male unit and the other the average prices per pound paid for the foods reported in four institutional studies adjusted to the 1926 price level by individual and by all food index numbers.

Growth of private day school boys, R. G. FREEMAN, JR., and R. SEARFOSS (*Arch. Ped.*, 46 (1929), No. 7, pp. 450-455, figs. 5).—Data are reported on the growth in height for age of boys in a private day school in New York City. A total of 986 measurements were taken at 6-months intervals for a period of 3 years on boys ranging from 6 to 15.5 years of age. At all ages the boys in the present series were taller than the private school boys reported on by Gray and Fraley (*E. S. R.*, 56, p. 394). At the ages of 6, 10, 11, and 13 years the differences exceeded three times the probable errors. Within the age range there existed two major phases of accelerated growth, one between 11 and 12 years and another between 14 and 14.5 years, and a minor phase at 7 years.

Basal metabolism of children of abnormal body weight.—I, Basal metabolism of overweight children, A. TOPPER and H. MULLER (*Jour. Amer. Med. Assoc.*, 92 (1929), No. 23, pp. 1905-1907, figs. 3).—Data are reported on the basal metabolism of 35 boys and 35 girls from 6 to 14 years of age whose weight exceeded normal limits by from 13 to 75 per cent, but who were otherwise apparently normal. The determinations were made in duplicate in the post-

absorptive state, using the Krogh calorimeter. Age was taken to the nearest birthday, standing height measured without shoes, and weight recorded in kilograms in indoor clothing without shoes. The nutritional state was calculated by the Pirquet pelidisi system, the Baldwin-Wood scale, the Pirquet-Camerer scale, and the Talbot prediction standards based on height alone. Of all these standards, the Pirquet was considered the best single standard for all cases, although in most cases the Talbot and Pirquet standards agreed within 5 per cent.

According to the Pirquet standards 71 per cent of the subjects showed a normal basal metabolic rate with a tendency toward high rather than low values. The remaining 29 per cent had basal metabolism rates more than 10 per cent above normal. Most of these subjects were between the ages of 12 and 14, and there was a greater proportion of girls than of boys. The girls also showed high values at a somewhat lower age than the boys. These findings are thought to suggest some association between increased metabolic rate and the prepuberty period.

Basal metabolism in children of abnormal body weight.—II, In underweight children, A. TOPPER and H. MUIER (*Amer. Jour. Diseases Children*, 38 (1929), No. 2, pp. 299-309, figs. 3).—When the investigation noted above was extended to a like number of underweight children, in 70 per cent of all cases the basal metabolic rates fell within the usual limits of ± 10 per cent, but with a tendency toward low rather than high normal values. Eight children, or 11.4 per cent of the total number, had basal metabolic rates above +10, and 13, or 18.6 per cent, below -10 per cent. The low rates were in most cases associated with excessive underweight, but the 8 children who had rates above +10 per cent were markedly underweight. As in the previous study, these were all between the ages of 12 and 14 years. This is thought to confirm the suggestion made in the previous study that at the period of puberty in certain children there is probably a temporary increase in function of the thyroid gland associated with an abnormally high basal metabolic rate.

Obesity as a precursor of diabetes, S. F. ADAMS (*Jour. Nutrition*, 1 (1929), No. 4, pp. 339-342).—In this contribution from the Mayo Clinic, Rochester, Minn., available data on the weight with reference to age of 673 diabetic patients before and after the onset of diabetes have been compared with values from actuarial tables with the conclusion that 91 per cent of the patients were overweight, 52.9 per cent being more than 10 per cent overweight before the onset of diabetes. Grouped by age the data showed that as age increased to the fifth decade the subjects showed an increased tendency to overweight, while after the age of 50 the percentage of overweight was slightly lower. More than 30 per cent of the subjects less than 20 years of age were more than 10 per cent overweight before the onset of diabetes.

As far as could be judged by case reports, the obesity was the result of overeating and thus preventable in over half of the entire group. "Education should help in preventing diabetes, since obesity seems to be such an important precursor of the disease. When people realize that a gain of weight is as significant a sign as acute pain is a significant symptom, timely steps may be taken to reduce the incidence of diabetes."

Ways in which emotion can affect the digestive tract, W. C. ALVAREZ (*Jour. Amer. Med. Assoc.* 92 (1929), No. 15, pp. 1231-1237).—The author reviews from his own clinical experience and from literature on the subject evidence of psychic stimulation and inhibition of peristalsis and of the flow of the salivary, gastric, and pancreatic juices.

"It is suggested that more effort be made to warn patients against eating when absent-minded, mentally upset, or greatly fatigued. Not infrequently

some article of food gets the blame for an attack of indigestion when the trouble was really due to the fact that a large meal was put into a stomach that was not ready to receive it."

The bacteriology of dry milk, with particular reference to that made by the Just process, G. C. SUPPLEE and E. M. BIXBY (*Amer. Jour. Diseases Children*, 37 (1929), No. 5, pp. 1016-1026).—Samples of dry milk prepared by the Just double roller process were examined for bacterial content immediately after drying and at the time of final packing. The average total count for 20 samples was 133 at the time of removal from the drying cylinder and 264 at the time of packing. Composite samples from another factory gave an average of 564. Of 267 colonies examined morphologically, 66 per cent were rods, 25 per cent staphylococci, and 9 per cent micrococci. No streptococci were found.

In view of the report by Dick and Dick (*E. S. R.*, 58, p. 594) indicating the presence of hemolytic and green-producing streptococci in milk powder of undesignated origin, various samples of milk were inoculated with strains of such organisms and were then dried by the Just process and examined. All of the organisms were destroyed. An examination of samples of milk powder prepared by the spray process showed a higher total bacterial count and total count of hemolyzing colonies than milk prepared by the Just process.

On the presence of aluminum in plant and animal matter, L. KAHLENBERG and J. O. CLOSS (*Jour. Biol. Chem.*, 83 (1929), No. 1, pp. 261-264, pl. 1).—In this complete report of the investigation noted from a preliminary report (*E. S. R.*, 61, p. 589), the technic employed is described and photographs are included of absorption spectra of the ash of various materials, all of which showed the presence of aluminum.

The copper content of plant and animal foods, C. W. LINDOW, C. A. ELVEHJEM, and W. H. PETERSON (*Jour. Biol. Chem.*, 82 (1929), No. 2, pp. 465-471).—The copper content of about 160 samples of common food materials has been determined by the method previously described (*E. S. R.*, 61, p. 612). The values obtained, which are reported in milligrams per kilogram on the dry basis and fresh material, respectively, range from 0.1 mg. per kilogram in fresh celery to 44.1 mg. per kilogram in fresh liver. Arranged in descending order of copper content, the different classes of foods are as follows: Nuts, dried legumes, cereals, dried fruits, poultry, fish, animal tissues, green legumes, roots, etc., leafy vegetables, fresh fruits, and nonleafy vegetables. Hog liver contained 6.5, beef liver 21.5, and calf liver 44.1 mg. per kilogram of fresh material. Oysters were much richer in copper than any of the other sea foods examined, containing 30.7 mg. per kilogram of fresh material. Milled cereals were much lower in copper than the whole grains from which they were made.

Hemoglobin maintenance upon synthetic diets, D. L. DRABKIN and C. S. WAGGONER (*Science*, 69 (1929), No. 1792, p. 480).—The synthetic diet for dogs described by Cowgill (*E. S. R.*, 50, p. 367) has been found to contain copper to the extent of 0.052 mg. per 16 gm. (the amount fed per kilogram of body weight). The sources of this copper proved to be commercial casein and Vitavose. On substituting for these constituents coagulated egg albumin and Harris yeast concentrate with brewer's yeast, respectively, a copper-free diet suitable for rat feeding experiments was obtained. No differences could be detected in the growth of rats on this copper-free diet and the same with the addition of small amounts of copper sulfate. Both proved equally effective in the cure of rats rendered anemic by an exclusive milk diet.

Iron in nutrition, VIII, IX (*Jour. Biol. Chem.*, 83 (1929), No. 1, pp. 243-260, figs. 8).—Continuing the series of studies previously noted (*E. S. R.*, 59, p. 892), two papers are presented.

VIII. *The ineffectiveness of high doses of iron in curing anemia in the rat.* J. Waddell, H. Steenbock, and E. B. Hart (pp. 243-250).—In this study, in which the authors had the cooperation of E. Van Donk, iron wire such as is used in the preparation of pure iron salts was found to contain sufficient copper to cure anemia in rats when the salts prepared from it were fed at high levels. When the salts were freed from copper by treatment with hydrogen sulfide they were no longer capable of curing anemia. It is believed that the success reported in the literature in the treatment of anemias with heavy doses of so-called pure iron salts is attributable to copper contamination, and that this may also be true in the cure of human anemias with inorganic iron.

IX. *Further proof that the anemia produced on diets of whole milk and non is due to a deficiency of copper.* J. Waddell, H. Steenbock, C. A. Elvehjem, and E. B. Hart (pp. 251-260).—Further proof that copper is the only element responsible for the supplementing effect for iron in the cure of anemias produced in rats by whole milk was obtained by the authors, with the cooperation of E. Van Donk, in the cure of such anemia by several liver preparations, hydrogen sulfide fractions of the acid extracts of the ash of two of these preparations, and with copper as a solution of copper sulfate, all furnishing the same amount of copper.

An iodine survey of Nebraska, W. H. ADOLPH and F. J. PROCHASKA (*Jour. Amer. Med. Assoc.*, 92 (1929), No. 26, pp. 2158-2160, fig. 1).—Analyses for iodine by the McClelland method (E. S. R., 52, p. 712) are reported for food materials grown in the vicinity of Lincoln and for samples of water and unmanured soil from different parts of the State. The tabulated data for food materials compare favorably with typical results for the same materials reported from nongoitrous regions. The iodine content of water from deep wells in seven towns in different parts of the State varied from 0.5 to 30 parts per hundred billion. The iodine content of the soils was very low, 5 of the 8 samples showing no appreciable iodine and 3 only 15 parts per billion. It is noted that in the records of the draft examinations during the World War Nebraska was ranked as a nongoitrous State and that school physicians in the State assert that goiter is very rare among school children.

Distribution of endemic goiter in the United States as shown by thyroid surveys, R. OLESEN (*Pub. Health Rpts. [U. S.]*, 44 (1929), No. 25, pp. 1465-1487, fig. 1).—This paper consists chiefly of a compilation from various sources of data on thyroid surveys in 43 States. For purposes of comparison data are included on the extent of thyroid enlargement by States among the enlisted men in the World War.

A domestic liver extract for use in pernicious anemia, W. B. CASTLE and M. A. BOWIE (*Jour. Amer. Med. Assoc.*, 92 (1929), No. 22, pp. 1830-1832).—Detailed directions are given for the home preparation of a potent liver extract for the treatment of pernicious anemia. The process, which is based upon the first steps of the original procedure of Cohn et al. (E. S. R., 39, p. 692), requires no other apparatus than a meat grinder and ordinary kitchen utensils and not more than 30 minutes of time daily. Inexpensive beef liver can be used in place of the more expensive calf liver. The extract is said to taste like beef broth and to be almost entirely free from the peculiar flavor of liver.

A case report is included, showing the efficacy of the homemade extract in the treatment of pernicious anemia.

Tryptophane and growth.—I, Growth upon the tryptophane-deficient basal diet supplemented at varying intervals by the separate feeding of tryptophane, C. P. BEAG and W. C. ROSE (*Jour. Biol. Chem.*, 82 (1929), No. 2, pp. 479-484, figs. 2).—It has been found that within certain limits the frequency

of administration of tryptophane to animals upon tryptophane-deficient basal diets affects the rate of increase in body weight. If half the daily allowance is fed at 12-hour intervals better growth is secured than when the total allowance is fed at one time. More frequent administration than twice daily does not induce significantly better growth. "It is suggested that amino acids may differ as to the frequency with which they must be supplied when fed apart from the other components of the ration, but until more definite information is secured it appears desirable in such studies to administer the supplementing compound at least twice daily."

Application of statistical methods in physiology, H. L. DUNN (*Physiol. Rev.*, 9 (1929), No. 2, pp. 275-398, figs. 6).—This extensive discussion of the use and abuse of statistical methods in physiology is presented under the following headings: Prerequisites to the application of statistical methods, the use of statistics as a laboratory tool, cautions to be observed in the use of the statistical method, presentation and preservation of original data, and analysis of mass data. Useful tables of statistical formulas, a glossary of symbols used in statistical methods, and an extensive bibliography with cross index are appended.

High temperature deaths among experimental rats, H. C. CAMERON (*Science*, 69 (1929), No. 1796, p. 576).—This is a brief note calling attention to the necessity of temperature control in rat laboratories. In the author's experience several deaths have occurred among normal rats as well as those suffering from vitamin A deficiency when the temperature has risen to 96° F.

The heat production of the albino rat, I, II, F. G. BENEDICT and G. MACLEOD (*Jour. Nutrition*, 1 (1929), Nos. 4, pp. 343-366, figs. 3; 5, pp. 367-398, figs. 3).—Two papers of this series are given.

I. Technique, activity control, and the influence of fasting.—In the first paper, reporting an investigation of the heat production of the albino rat as affected by various factors, a closed-circuit respiration chamber for measuring (usually in 2-hour periods) both the carbon-dioxide production and oxygen consumption of the rat is described, and methods employed by other investigators in studying the gaseous metabolism of rats are summarized.

The method employed in the present investigation for registering graphically the rat's activity and interpreting such records is discussed and applied in a study of the relationship between the rat's metabolism and its activity. It was found that in 2-hour periods a minor amount of muscular activity had no effect and momentarily excessive activity only a minor effect upon metabolism, and that repeated intermittent activity, if not long-continued, caused an increase in metabolism of not over 15 to 20 per cent. From these observations it was concluded that in the case of the rat graphic registration of activity is unnecessary, and that ocular observation with the discarding of results when the rat is constantly moving is sufficient.

A study of the effect of fasting upon the metabolism of rats showed that the heat production in rats over 4½ months of age, measured in Calories per square meter of body surface per 24 hours at 26° C., decreased on the average from 7 to 13 per cent during the first 17 to 24 hours of fasting, but remained essentially constant thereafter up to the sixty-fourth hour. With rats younger than 4 months, the metabolism decreased 28 per cent during the first 24 hours. It is concluded that the effect of any superimposed factor upon metabolism can be studied satisfactorily after the rat has been fasting 17 hours.

II. Influence of environmental temperature, age, and sex; comparison with the basal metabolism of man.—Following the technic described above the authors have determined the influence of various factors upon the basal metabolism of the rat.

With increasing environmental temperature up to 28° C., the heat production, measured in the post-absorptive state 17 hours after food, decreased progressively. Above that temperature values were approximately the same. In the authors' opinion the basal metabolism of rats should be measured only at this critical temperature.

Season was found to have a distinct effect upon the metabolism. The heat production during the winter of a group of 21 adult rats averaged 835 calories per square meter of body surface per 24 hours and that of a group of 17 rats during the summer 736 calories, although the temperature of the calorimeter averaged the same at both seasons. A possible explanation of the seasonal differences was suggested by the fact that the rats studied at 28° after living 24 hours at this temperature had a lower heat production than those whose metabolism was determined at the same temperature after living 24 hours at 21°. It is thought that "in experiments in which the influence of long-continued feeding on some special diet or the influence of some other particular factor is to be investigated, one must recognize that a change in metabolism due to change in season may possibly mask or minimize or, on the other hand, intensify the effect of the superimposed factor under study."

In the female rats, after 2 months of age, the heat production per unit surface increased with increasing age. This was also true of the males, although the data were not so abundant. Males had a distinctly higher metabolism than females. The heat production of 3 rats shortly before death showed a very marked decrease. The average basal metabolism of rats 2 months old and over, measured at 28°, is estimated to be 720 calories per square meter of body surface for females and 800 for males. "These are values approximately 150 calories lower than the basal values for humans and challenge attention immediately, in the first place because of their approximation to the human metabolism, and secondly because of the fact that the metabolism of the female rat is low rather than high when compared with the metabolism of women."

The vitamin A content of avocados, L. S. WEATHERBY, J. E. YOUTZ, and R. V. WARREN (*Jour. Home Econ.*, 21 (1929), No. 5, pp. 360-364, figs. 2).—The California avocado, Calavo grade, was found to be quite rich in vitamin A, 2.5 gm. per rat per day furnishing enough of this vitamin for growth at a more rapid rate than the Sherman standard of 3 gm. per week during the 8-weeks experimental period. Similar studies on vitamin B have been noted previously (*El. S. R.*, 61, p. 238).

Relation of soil fertility to vitamin A content of leaf lettuce, M. DYE and J. W. CRIST (*Jour. Nutrition*, 1 (1929), No. 4, pp. 335-338, figs. 2).—Continuing their investigation of variations in the content of vitamin A in lettuce (*El. S. R.*, 57, p. 895), the authors have compared as sources of vitamin A lettuce grown from selected seed under uniform conditions on three types of soil—a sandy loam soil; the same fertilized with sheep manure and a mixture of c. p. KNO_3 , $\text{CuH}_4(\text{PO}_4)_2$, and KCl ; and the same with four times as much of the salt mixture but no manure. Photographs of representative plants from the three soils are given showing increased vigor and size of the plants from the untreated soil to the one receiving full salt treatment but no manure, and data are given on the composition of the plants.

Cumulative growth curves based upon average gains in weight made by groups of 10 animals fed each type of lettuce in 2-gm. daily amounts after depletion on the basal diet showed only slight differences for the first two weeks, and after that an increased rate of growth in the same order as shown by the growth of the plants. The differences in the composition of the three grades of lettuce are considered not to explain the differences in growth.

Differences in the greenness of the three sets of plants were quite marked, and are thought to afford another illustration of the relationship between vitamin A content and degree of greenness.

The effect of purified diets, and their modifications, on growth and testicular degeneration in male rats, K. E. MASON (*Jour. Nutrition*, 1 (1929), No. 4, pp. 311-334, figs. 3).—Previous testicular studies, based on male rats fed a basal vitamin E-free 18 per cent casein diet (E. S. R., 55, p. 194), have been extended to studies on the sterility-producing effect of other purified diets in which the protein was furnished by 35 per cent of casein, edestin, or lactalbumin, or 20 or 30 per cent of meat residue, these proteins with starch constituting 72 per cent of the entire diet. Various growth-promoting supplements were added in some cases, these including cod-liver oil; lettuce, dried or fresh; and dried alfalfa. Lard, butterfat, salt mixture, and yeast were fed in constant amounts. In addition to 45 male rats on special experiment, over 160 rats used by Osborne and Mendel in various growth studies were included in the sterility and autopsy studies. No extensive observations were made on fertility by means of mating experiments, attention being focused chiefly on the testicular changes.

The testicular degeneration previously described as occurring on the basal diet with 18 per cent casein was found to occur as rapidly in rats fed similar diets with the other proteins listed above. Daily supplements of 5, 10, 20, 30, or 40 gm. of fresh green lettuce or 1.6 gm. of dried lettuce (equivalent to 33.5 gm. of fresh) prevented testicular degeneration, but daily supplements of 0.34 and 0.68 gm. of dried lettuce and of 0.4 gm. of dried alfalfa were inadequate. Although the fresh lettuce was about eight times as rich in vitamin E as the dried equivalent, the fresh and dried lettuce had approximately the same stimulating effect on growth.

The possible relation of this growth-promoting factor to vitamin E and other growth factors is discussed, with various references to the literature bearing on the subject. The author is of the opinion that vitamin E *per se* is not responsible for this growth stimulation and that possibly another unknown factor is involved. The possibility is also suggested, although considered still unproved, that vitamin E is specific for the male sex glands only.

Histological examination of other organs of sterile male rats revealed no histopathological changes.

The distribution of vitamin B₂ in certain foods, W. R. AYKROYD and M. H. ROSCOE (*Biochem. Jour.*, 23 (1929), No. 3, pp. 483-497, fig. 1).—In this investigation of the distribution of vitamin B₂ (G) in various parts of the wheat and corn kernels, the technic followed was essentially as described by Chick and Roscoe (E. S. R., 60, p. 690). The basal diet consisted of specially purified casein 20, rice starch 60, cottonseed oil 15, and McCollum's salt mixture (185) 5 parts, with 100 parts of water, the whole being cooked in a double boiler for 3 hours at 100° C. to prevent refection. The proportion of protein:carbohydrate:fat (20:60:15) of this basal diet was kept constant when the materials to be tested were added by suitable alterations in the proportion of casein and starch. In no case did the cereal protein replace more than half of the casein of the original basal diet, and in most cases it replaced about one-third.

Young rats just weaned and weighing from 30 to 45 gm. each were fed for a week on the basal diet plus 3 drops (0.05 gm.) of cod-liver oil. At the end of the week they were placed in separate cages, and the experimental diet containing the substance to be tested was fed with 0.1 cc. daily of Peters' antineuritic concentrate, one rat being left as a negative control on the basal diet plus cod-liver oil plus antineuritic concentrate. The growth during the first week on the experimental diet was disregarded, and the weekly growth rate

for the succeeding 4 weeks was used for comparison with what was considered normal growth, 11 to 14 gm. weekly during that period. From this comparison the vitamin B₂ value was estimated as the minimum daily ration needed to maintain normal increase in body weight (11 to 14 gm. weekly) during the 4-weeks period.

In addition to the cereals, various other foods were tested by suitable additions to the basal diet. Curative experiments were also conducted on rats suffering from dermatitis brought about by the B₂ deficient diet.

Whole wheat was not a rich source of vitamin B₂, the amount required for normal growth under the conditions defined averaging about 50 per cent of the diet. Wheat endosperm, either as top patent flour or household flour, was a poor source of the vitamin, 65 per cent of either producing very little growth. Of wheat bran and embryo, from 15 to 30 per cent gave normal growth. Considering the composition of the wheat kernel, the bran is considered the best source of vitamin B₂.

Yellow corn was inferior to either of the two samples of wheat tested and white corn equivalent to the wheat of lowest value, 50 per cent being required for normal growth. The endosperm as grits or polenta was very low, almost no growth being secured with 65 per cent. Of corn germ meal, 60 per cent was needed for normal growth as compared with 30 of wheat germ meal. Dried peas were found to have a rather low content of B₂, 45 per cent of the diet being necessary for normal growth.

Other materials tested, with amounts necessary for the standard growth during the 4-weeks period, were dried ox liver 0.06 to 0.12, dried yeast 0.1 to 0.2, autoclaved yeast 0.4, egg yolk cooked and dried 0.5 to 1, dried steak 0.5 to 0.75 gm., and fresh whole milk from 3 to 6 cc. From records of food consumption, a dosage of 1 gm. dry weight would represent from 12.5 to 14 per cent of the dry weight of the total food consumed. The various products tested were thus much richer in vitamin B₂ than the cereals.

In the curative tests, the materials proved effective in the same order as in the growth tests. In addition Cheddar cheese and egg white were tested. The former proved less effective than milk, 2 gm. daily of the cheese (1.3 gm. dry weight) being equivalent to 6 cc. (0.7 gm. dry weight) of the milk. Egg white was more potent, 5 gm., equivalent to 0.6 gm. dry weight, curing the symptoms rapidly.

A rough comparison of the value of the different foods tested for the prevention of B₂ deficiency in rats, pellagra in man, and blacktongue in dogs showed fair agreement, leading the authors to state that "there seems little doubt that the condition produced in rats by a diet deficient in vitamin B₂ is the analogue of human pellagra. We suggest that our method might be useful in tackling any problems in the human disease that remain to be solved. It is worth noticing that the rat, as compared with man and the dog, is relatively insusceptible to pellagra. Diets that produce florid pellagra in man and blacktongue in dogs do not cause dermatitis in rats, and only a rigorous purification of the basal diet can insure the appearance of symptoms."

A method for the assay of the antineuritic vitamin B₂, in which the growth of young rats is used as a criterion, H. CHICK and M. H. ROSCOX (*Biochem. Jour.*, 23 (1929), No. 3, pp. 498-503, fig. 1).—The discovery that egg white is a rich source of vitamin B₂ (G) free from B₁ (F) has led to attempts to use it in place of the purified casein of the basal diet described in the previous paper for the assay of vitamin B₁. Young rats receiving this diet shortly after weaning are said to grow for from 2 to 3 weeks, after which growth ceases for lack of vitamin B₁. If at this point Peters' antineuritic concentrate is given the animals recover and grow normally for several weeks,

but there is a gradual slowing of the growth rate before maturity. This slowing of the growth rate is thought to indicate a third dietary factor in the vitamin B complex. This factor is heat-stable and is present in autoclaved yeast but lacking in egg white.

If 0.4 cc. of autoclaved yeast is used as the source of vitamin G with the basal diet described in the previous paper, the preliminary period of growth is longer than on the egg white, and in some instances growth is more rapid in the recovery tests. This is thought to point to the presence of traces of vitamin B₁, but the material is at present considered more satisfactory than egg white.

"If the unit of vitamin B₁ be defined as the amount which will restore normal growth (weekly increase in weight of about 10 to 14 gm.) in young rats whose growth has failed on a basal diet deficient only in this vitamin, assay of a foodstuff for content of vitamin B₁ would consist in determination of the minimum dose necessary to restore this degree of growth."

Hypervitaminosis and vitamin balance.—Part II, The specificity of vitamin D in irradiated ergosterol poisoning. Part III, The pathology of hypervitaminosis D, L. J. HARRIS and T. MOORE (*Biochem. Jour.*, 23 (1929), No. 2, pp. 261-273, figs. 4).—Further evidence is reported confirming the authors' previous conclusions (E. S. R., 61, p. 297) that excessive vitamin D is in itself responsible for a specific hypervitaminosis apart from any possible ill effects of poisonous by-products. The evidence consisted (1) in a demonstration of the non-toxicity of overirradiated ergosterol prepared from the same specimen of irradiated ergosterol which had previously been shown to be toxic, (2) in the demonstration that ergosterol irradiated in different solvents (alcohol and oil) was equally toxic in the same massive doses, and (3) that ergosterol irradiated in the absence of a solvent was likewise toxic.

On post-mortem examination the experimental animals on the various high vitamin D dosages invariably showed the condition described by Kreitmair and Moll (E. S. R., 60, p. 693) rather than that described by Dixon and Hoyle (E. S. R., 60, p. 692). In addition, other pathological conditions not previously noted were observed, including remarkably high blood phosphate, a tendency toward diminished pH of the feces, diminished heart rate, and on post-mortem examination, atrophy of the thymus.

In endeavoring to explain the divergent results reported from different laboratories, it is suggested that in cases where pathological symptoms were not observed the toxic threshold for vitamin D had probably not been reached.

Further observations on the effects of large doses of irradiated ergosterol, J. C. HOYLE and H. BUCKLAND (*Biochem. Jour.*, 23 (1929), No. 3, pp. 558-565, figs. 3).—The experiments of Dixon and Hoyle (E. S. R., 60, p. 692) have been repeated, with the addition of analyses of the urine to determine the immediate cause of the formation of the calculi found in such animals. The analyses include total volume of the urine per rat per day and estimates of the pH value and the content of phosphate and chlorine.

The effects described in the previous paper were confirmed with the possible exception of finding a slight degree of arteriosclerosis in the aortas of four of the experimental animals. All of the animals showed a persistent diuresis without any significant increase in either the total phosphate or chloride output. The average urinary pH of the experimental animals was slightly more alkaline than that of the controls, but there was no evidence of any precipitation of the phosphates.

A brief note of comment on the paper of Harris and Moore, noted above, is appended in which attention is called to the differences in the experimental findings.

The effect of excessive doses of irradiated ergosterol on the calcium and phosphorus content of the blood, L. J. HARRIS and C. P. STEWART (*Biochem. Jour.*, 23 (1929), No. 2, pp. 206-209).—In this preliminary note, occasioned by the report of Hess, Weinstock, and Rivkin (*E. S. R.*, 61, p. 596), data are reported on the effect of massive doses of ergosterol irradiated in alcohol on the blood calcium and phosphorus of adult rabbits on a normal mixed diet and of young rats on a complete synthetic diet of normal calcium-phosphorus ratio.

In the rabbit series the administration of irradiated ergosterol in doses of 10 mg. per day caused no changes in the level of phosphorus or calcium for nearly a month, after which there was a 50 per cent increase in the inorganic phosphate. After six weeks there was still no appreciable increase in serum calcium, although abnormal deposits of calcium were evident in various parts of the body.

In the single experiment conducted on rats, a dosage of irradiated ergosterol amounting to 0.1 per cent of the diet was followed after 14 days by a 50 per cent increase in the inorganic phosphate of the blood and a 25 per cent increase in the serum calcium.

The influence of changes in body weight of the test rats on the accuracy of the assay of vitamin D by means of the line test, K. H. COWARD and M. R. CAMDEN (*Quart. Jour. Pharm. and Pharmacol.*, 2 (1929), No. 1, pp. 44-47).—Selected data are reported showing the extent to which slight variations in weight of rats during the experimental period in vitamin D studies may affect calcification of the bones. It is noted that far greater irregularities in healing are evident in rats in which the degree of rickets is very slight. "This must be ascribed to the irregularities in the feeding of the animals previous to the experimental period, and it must be emphasized again that, unless this postlactation, preexperimental period is controlled as carefully as an experimental period, uniform results can not be obtained."

Effects of vitamin deficiency on the weight and cortex-medulla ratio of the suprarenal gland in rats, C. M. BLUMENFELD (*Anat. Rec.*, 42 (1929), No. 1, p. 45).—Based upon data obtained in comparisons of the weights of suprarenal glands and the ratios of cortex to medulla in 13 test rats and 10 controls in vitamin A and D studies and in 23 test rats and 8 controls in vitamin B studies, the following conclusions were drawn:

"In the rats on diets deficient in vitamins A and D, the glands appeared variably hypertrophied (maximum about 47 per cent) in 7 cases with severe infections in the nose and middle ears, but were below normal weight in the 6 others. The volume of the medulla was relatively increased in both hypertrophic and atrophic glands. In the B-deficient rats the glands were in most cases enlarged to a variable extent (maximum 114 per cent) and grayish-translucent in color. No infections were observed in this series. The suprarenal enlargement appeared inversely proportional to the amount of vitamin B in the diet and was greater in the males. The cortex-medulla ratio was somewhat variable."

The hydrogen ion concentration and the calcium and phosphorus content of the faeces of rachitic children, T. REDMAN (*Biochem. Jour.*, 23 (1929), No. 2, pp. 256-260, figs. 8).—In this study, which supplements a previous investigation of the relation of the pH of the feces of rachitic children to their clinical condition (*E. S. R.*, 59, p. 96), determinations were made of the H-ion

concentration of fresh samples of feces of children under different treatments for rickets, and of the calcium and phosphorus content of the same samples when dried. The data are presented in curves in which each of these factors was plotted against the time of treatment until healing was established. The children were all on the same mixed diet, but received different treatments as follows: Cod-liver oil and malt, together with irradiation from a carbon arc lamp or mercury vapor lamp; Ostelin; irradiated ergosterol; Radio-malt; and irradiated cholesterol.

In general there was a certain degree of correlation between the pH and the percentage of calcium in the feces, but no regular correlation with the phosphorus content. The best clinical results were obtained with irradiated cholesterol, and in this series the pH values were practically all below 7. Healing appeared to be more rapid when the percentage of phosphorus was consistently low.

Production of scurvy in the guinea pig, young or adult, by means of a new well-defined artificial ration [trans. title], L. RANDOIN and R. LECOQ (*Compt. Rend. Soc. Biol. [Paris]. 101 (1929), No. 24, pp. 877-879, fig. 1*).—The scorbutic ration described in this paper differs from the earlier one of Lopez-Lomba and Randoin (*E. S. R.*, 50, p. 166) chiefly in the substitution for navy bean flour of 17 parts of meat peptone and 64 of cornstarch, also consisting of brewery yeast 3, butterfat 5, Osborne and Mendel salt mixture 2, sodium chloride 1.5, calcium lactate 5, and filter paper 2.5 per cent. In preparing the ration, the peptone, starch, salts, and filter paper are mixed with from 130 to 135 gm. of water, heated slowly to boiling, and cooked until about 30 to 35 gm. of water has evaporated. After the mixture has cooled a little the butterfat and yeast are added.

Guinea pigs placed on this diet consume from 90 to 150 gm. per day, depending upon their weight. As a rule there is no loss in weight from the fourteenth to the eighteenth day, when the first signs of scurvy appear. The disease becomes rapidly acute and loss in weight is very rapid, amounting to from 125 to 200 gm. in less than two weeks. Death results in from 25 to 32 days. On autopsy the characteristic symptoms of scurvy are evident, especially a hemorrhagic congestion of most of the organs and friability of the teeth and bones. Complete protection is secured by the daily addition of 2 cc. of lemon juice to the diet of animals weighing less than 400, and 3 cc. to those weighing over 400, gm.

TEXTILES AND CLOTHING—HOME MANAGEMENT AND EQUIPMENT

The textiles we buy and use, H. E. MCCULLOUGH (*Illinois Sta. Circ. 347 (1929), pp. 94, figs. 56*).—Popular information has been compiled on fibers used in weaving cloth, textile designs, finishing processes, textile tests and costs, and the development of better textile service.

Human energy cost of operating a vacuum cleaner at different speeds, V. SWARTZ (*Jour. Home Econ.*, 21 (1929), No. 6, pp. 439-446).—This investigation, conducted in the laboratories of a vacuum cleaner company, was undertaken to determine the energy cost of operating a vacuum cleaner and the most efficient speed of operation. An intensive series of experiments was first conducted on one subject, the author, and this was followed by a confirmatory series with nine other subjects, most of them women graduate students of the University of Chicago. The speeds studied were 0.5, 1, 2, 3, and 4 ft. per second, the cleaner being operated on a 9 by 12 ft. Karnak Wilton rug. The

determinations were made by indirect calorimetry, using a Douglas bag. Each experiment proper was preceded by a preliminary work period of the same length. For purposes of comparison, metabolic determinations were conducted on the same subjects at rest and walking without the apparatus. In all 150 experiments were performed.

With all the subjects the resting values fell below the basal values predicted by the DuBois standards, ranging from -0.8 to -10.4 per cent. The total energy cost of operating the cleaner increased with increased speed, from 35.5 calories per square meter per hour at 0.5 ft. and 59.1 at 1 ft. per second to 146.3 at 4 ft. The net costs, representing the difference between total expenditure and expenditure for standing and walking, were low at the moderate speeds, being 7.4 calories at 0.5 ft. and 11 at 1 ft. per second. The net cost per unit of rug coverage was higher at both the very low speeds and the very fast ones, being 7.4 calories per square meter per hour at the 0.5-ft. rate, 5.5 at the 1-ft. rate, and 12.3 at the 4-ft. rate.

It was concluded that on the basis of efficient cleaning, 0.5 or 1 ft. per second is the most economical of human energy.

MISCELLANEOUS

Report of the Alaska Agricultural Experiment Stations, 1928, H. W. ALBERTS (*Alaska Stas. Rpt. 1928, p. [?] + 39, figs. 13*).—This contains the organization list and a report of the several lines of work carried on. Meteorological data and other features of the work are abstracted elsewhere in this issue.

Forty-first Annual Report [of Mississippi Station], 1928, J. R. RICKS ET AL. (*Mississippi Sta. Rpt. 1928, pp. 64*).—This contains the organization list, a report of the director on the work of the station, a financial statement for the fiscal year ended June 30, 1928, and departmental reports, the experimental work in which is for the most part abstracted elsewhere in this issue.

Hettinger Substation Report for 1923, C. H. PLATH (*North Dakota Sta. Bul. 229 (1929), pp. 28, figs. 7*).—The experimental work reported is for the most part abstracted in this issue. Meteorological data are also included.

Langdon Substation Report for 1927 and 1928, V. STURLAUGSON (*North Dakota Sta. Bul. 228 (1929), pp. 34, figs. 11*).—The experimental work reported is for the most part abstracted in this issue. Meteorological data are also included.

[Annual Report of Porto Rico Insular Station, 1928], M. T. COOK ET AL. (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt. 1928, Eng. ed. pp. 108, figs. 7*).—This contains the organization list and a report of the vice director for the fiscal year ended June 30, 1928, the experimental features of which are for the most part abstracted elsewhere in this issue.

NOTES

Georgia Station.—F. M. Cates, jr., of Waynesboro has been succeeded as a member of the board of directors by E. H. Blount, also of Waynesboro.

Association of Land-Grant Colleges and Universities.—In addition to the general officers previously enumerated (E. S. R., 62, p. 8), the following section officers were elected at the Chicago meeting, November 12-14, 1929: Agriculture, F. B. Linfield of Montana, chairman, Cornelius Betten of New York, vice chairman, and W. B. Mercier of Louisiana, secretary; engineering, R. A. Seaton of Kansas, chairman, and C. R. Jones of West Virginia, secretary; and home economics, Mary L. Matthews of Indiana, chairman, and Mary E. Creswell of Georgia, secretary. In the three subsections of the section of agriculture, E. J. Iddings of Idaho and F. H. H. Calhoun of South Carolina were chosen chairman and secretary, respectively, for that of resident teaching; H. W. Mumford of Illinois and F. J. Sievers of Massachusetts for experiment station work; and T. R. Bryant of Kentucky and J. C. Kendall of New Hampshire for that of extension work.

In the standing committees the following three-year appointments were made: Instruction in agriculture, home economics, and mechanic arts, H. S. Rogers of Oregon, Genevieve Fisher of Iowa, and E. H. Shinn of the Department of Agriculture; college organization and policy, J. A. Burruss of Virginia and J. J. Tigert of Florida; experiment station organization and policy, D. T. Gray of Arkansas and J. H. Skinner of Indiana; extension organization and policy, C. E. Ladd of New York and K. L. Hatch of Wisconsin; military organization and policy, W. Hulihan of Delaware and E. A. Burnett of Nebraska; engineering experiment stations, O. M. Leland of Minnesota; and radio problem, E. Bennett of Wisconsin and F. J. Kelly of Idaho.

In consequence of its inclusion as a standing committee, the committee on aeronautics was reorganized on a three-year basis. The membership consists of E. O. Holland of Washington (chairman) and A. A. Potter of Indiana for three years; W. L. Bevan of Iowa and E. B. Norris of Virginia for two years, and E. P. Warner of Massachusetts and L. D. Crain of Colorado for one year.

On the joint committee on projects and correlation of research, A. R. Mann of New York succeeded E. D. Merrill of California, and B. Youngblood of the Department of Agriculture. E. W. Allen. S. W. Fletcher of Pennsylvania was appointed to the joint committee on publication of research vice M. J. Funchess of Alabama, and H. G. Knight of the Department vice E. W. Allen.

The special Purnell committees were redesignated special research committees, with a membership which was unchanged.

The section on home economics elected a permanent committee on program and policy, consisting of Florence Harrison (chairman) of Washington and Jessie W. Harris of Tennessee for three years, Edith P. Chace of Pennsylvania and Mabel V. Campbell of Missouri for two years, and Martha Van Rensselaer of New York and Margaret M. Justin of Kansas for one year. Subsequently this committee appointed subcommittees with the following chairmen: Research, Margaret M. Justin of Kansas; college curriculum construction, Mabel V. Campbell of Missouri; methods of instruction, Genevieve Fisher of Iowa; adult education, Kathryn Van Aiken Burns of Illinois; housing, Abby L. Marlatt of Wisconsin; and land-grant college survey, Flora Rose of New York.

EXPERIMENT STATION RECORD

VOL. 62.

FEBRUARY ABSTRACT NUMBER

No. 3

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Outlines of biochemistry, R. A. GORTNER (*New York: John Wiley & Sons; London: Chapman & Hall, 1929. pp. XV+793, figs. 133*).—The author finds that "in a very large measure, the biochemistry of the American universities is not biochemistry in its strictest sense" but is more nearly "human pathological chemistry." Recognizing as obvious the necessity for strong departments of physiological chemistry associated with the medical schools, he none the less feels that there should likewise be recognized a necessity for a study of the fundamental reactions, primarily "the chemical and physicochemical reactions which take place in the normal biological organism, whether that organism be animal or plant."

In accord with the viewpoint indicated, the 10 chapters of the first section of the book, under the general head of the colloid state of matter, occupy somewhat more than one-third of the entire volume. The chapter headings of this section are the colloid state of matter; methods of preparation; certain physical properties characteristic of colloidal systems; H-ion concentration; electrokinetic phenomena of colloid systems; surface tension, interfacial tension, surface energy, and adsorption; electrolytes and colloid systems; gels; osmotic pressure and electrical conductivity; and the Donnan equilibrium.

Section 2, proteins, takes up the amino acids, the primary decomposition products of proteins, polypeptides, the analysis of proteins, protein structure and the possibilities of protein isomerism, protein classification, characteristic properties of protein systems, the reactions of proteins with acids and bases, the digestion and metabolism of proteins, the biological reactions of the proteins, and nitrogen bases. Section 3, dealing with carbohydrates and allied compounds, contains the captions: General considerations—the synthesis of carbohydrates in nature and the classification of carbohydrates; the structure of the monosaccharide molecule; chemical reactions of the monosaccharides; the higher sugars; the polysaccharides; the glucosides; and the pectic substances. Section 4 covers the tannins, in a single chapter. Section 5, plant pigments, divides its subject into the two chapters, chlorophyll and associated pigments, and the flavones, xanthenes, anthoxanthenes, and anthocyanins. The sixth section covers fats, lipides, and essential oils under the headings, the classification of the fats and allied substances and the general properties of the fats and oils, the lipides, and essential oils; and the seventh section comprehends the vitamins and enzymes under the general term, biocatalysts.

A reference list, author index, and an ample subject index are appended.

On the differences in physico-chemical properties of various proteins in plant seeds (third report), T. TADOKORO and K. YOSHIMURA (*Jour. Col. Agr., Hokkaido Imp. Univ.*, 20 (1928), No. 5, pp. 355-362).—The paper reports the isolation, by dialysis of the water extract of ground soybeans from which the fat had been removed, of a protein designated glycinin A, of a protein described as a legumelin by precipitation with ammonium sulfate from the filtrate from the glycinin A, and of a protein distinguished as glycinin B extracted from the residue left after the water extraction by treating this residue with 10 per cent sodium chloride solution; and, finally, of a glutelin soluble in 0.2 per cent sodium hydroxide solution from the material previously extracted both with water and with 10 per cent sodium chloride.

The ash and phosphorus contents of the legumelin, the glycinin, and the glutelin decreased, and the nitrogen content increased, in the order in which the proteins are named. The glycinin appeared to have the highest isoelectric pH point, the legumelin the lowest. In specific rotatory power in alkaline solution and in combining power with respect to hydrochloric acid the glycinin was found to stand first.

"The content of free amino nitrogen of glycinin is greatest, that of glutelin is next, and that of legumelin is smallest. The melanin nitrogen of glycinin is . . . far beyond that of other proteins. On the contrary, the histidine content of legumelin is superior and the lysine nitrogen of glutelin is superior to that of other proteins.

"Glycinin, which is the main protein of soybean, has the highest pH value, greatest specific rotatory power, nitrogen, free amino, and melanin nitrogen content. From these chemical properties glycinin seems to be the most polymerized amongst these proteins. So the chemical properties of soybean glycinin are quite different from those of oryzenin of rice."

On the alcohol-soluble proteins of naked barley, E. TAKAHASHI and K. SHIRAHAMA (*Jour. Faculty Agr., Hokkaido Imp. Univ.*, 21 (1927), No. 2, pp. 45-62, figs. 2).—The alcohol-soluble proteins were separated from the new and old naked barley, and their nature was studied from the physicochemical and pure chemical viewpoints. Two of the new proteins separated were found to be the same, but the remaining two proteins were different in their nature from the first two. The alcohol-soluble proteins of the naked barley seemed, therefore, not to be a homogeneous substance as in the case of hordein of the common barley obtained by Osborne. In addition it seemed that the proteins in the old and new naked barley were somewhat different in nature. "However, still further research will be required as to the identity of the alcohol-soluble proteins of the common barley with those of the naked barley, and as to the nature of the proteins in relation to the age of the grains and to the so-called denaturation in the course of the preparation of samples which gives the protein more or less change of properties."

Chemical studies on the ripening of rice seed and chemical properties of rice of the early ripening subvarieties, T. TADOKORO (*Jour. Col. Agr., Hokkaido Imp. Univ.*, 20 (1928), No. 5, pp. 333-354).—The paper is divided into two parts, of which the first, concerned with the chemical changes accompanying the ripening of rice seed, records the observation that the nonprotein content decreases while the protein content increases during the ripening of rice seed, the composition of the principal protein being altered meanwhile in the direction of decreasing monoamino and increasing diamino fractions, of increasing specific rotation, free amino nitrogen, and lysine contents, and of decreasing the arginine content "up to a definite point in the ripening period. At this date the isoelectric point decreased in its acidic nature, and then these physico-

chemical properties under consideration became reversed in the later period." It was also noted that "during the ripening period the chemical properties of starches vary and in the middle part of the ripening period the ash and phosphorus contents decrease, the acetyl group content of acetyl starch increases, and its specific rotatory power decreases."

The work noted in the second section of the paper takes up certain of the chemical characteristics found to distinguish the early ripening subvarieties investigated, of which it was concluded that "the early ripening subvarieties are rich in fat and nonproteid content while the content of ash and proteid is less in comparison with the later ripening subvarieties. The early ripening rice is rich in water-soluble protein, the isoelectric point of its oryzenin is acidic, and its specific rotatory power is low in comparison with the later ripening subvarieties. In the early ripening subvarieties the free amino nitrogen content of oryzenin is less than in the later. These characteristics show that the seed of the early ripening subvarieties is not completely ripened."

The chemical composition of the sunflower at various stages of growth [trans. title], S. HJORTH-HANSEN (*Meld. Norges Landbr. Høiskole*, 8 (1928), No. 6, pp. 334-339: *Eng. abs.*, pp. 338, 339).—Noting that in recent years sunflowers have found place as a silage plant in Norwegian agriculture, the author presents a brief account of analyses both of fresh and of dry material, taken at various stages of the growth of the plant, and including leaves, stems, and flowers, separately examined. The substances or quantities determined included dry matter, ash, ether extract, crude cellulose, total protein, albuminoid protein, amides, protein soluble in pepsin hydrochloric acid solution, digestible albuminoid protein, nitrogen-free extractives, etc. These analyses were made upon material collected on August 25 and September 13 and 28. Frozen leaves were similarly examined.

The leaf samples showed the highest digestibility on the second of the above dates of harvesting, the stems on the first collecting date. The digestion coefficient of the stem protein was greater than that of the leaf protein, an observation considered explicable on the ground that the proteinaceous substances of the stem are composed largely of readily soluble amino acids, completely digestible.

Manganese, copper, zinc, boron, necessary factors in production of plants and animals (*Kentucky Sta. Rpt. 1928*, pt. 1, pp. 22, 23).—In this brief note it is stated that copper increased the growth and seed production of plants, and that zinc and boron increased the size and weight of the stalks and stems of plants, but without a corresponding increase in the seed yield. The concentrations used are not stated, but it is considered possible that "lower concentrations of these elements than those used might be favorable to seed production as well as to stalk and straw production."

Manganese, copper, zinc, and boron appear to have been found in higher concentrations in the liver, brain, pancreas, heart, lungs, and spleen than in the muscular tissues of animals, and in greater concentrations in the embryos of mammals than later.

White rat tests are considered to have indicated the importance of inorganic copper compounds in connection with iron compounds in the production of hemoglobin. Also, tissues and organs both of plants and of animals are stated to have been found to contain the greater proportions of the four elements in question in the parents showing the greater vitamin potency.

The determination of manganese in the presence of silica, C. NEWCOMB (*Analyst*, 53 (1928), No. 635, pp. 644, 645).—On extracting a highly siliceous ash (that of rice husks) the author found it impossible to secure complete extraction of the manganese content by any form of nitric acid treatment

followed by alkaline solutions. He therefore recommends the fusion of the ash with alkali carbonate, followed by solution of the melt in water. Such a solution, it was found, could be acidified without the precipitation of the silica, adsorption by which of the manganese compounds occasioned the original difficulty; and it was further possible to oxidize the manganese to the permanganate form without trouble, despite the colloidal character of the solution and the recognized fact that "the colloidal particles doubtless adsorb the manganese even more tenaciously than the original ash."

The oxidation was effected by treatment with ammonium persulfate, and filtration was not necessary since "any cloudiness of the extract clears up when the oxidation to permanganate occurs. The final solution, if everything has gone well, is a perfectly clear pink and can be read in a colorimeter against a standard permanganate solution, in spite of its being colloidal. It is quite stable and can be boiled or kept, for weeks if necessary, without flocculation."

The acidification of the solution of the alkali carbonate mass without the precipitation of silica was accomplished by pouring the alkaline solution at once into acid in excess of that required to neutralize it.

Methods of analysis (*Kentucky Sta. Rpt. 1928, pt. 1 p. 38*).—Plant tissue was oxidized for nitrate determination by means of sulfuric acid with a chlorate, the procedure being described as a rapid one.

Calcium hydroxide was used with copper sulfate as a means of securing from plant tissues the colorless solution required in the phenoldisulfonic acid method for the determination of nitrates.

Comparison with the hydrogen electrode "indicated that the quinhydrone electrode can not be satisfactorily used with Kentucky soils." The procedure employed gave quinhydrone electrode results "in general from 0.5 to over 1.0 pH higher than the hydrogen electrode," the discrepancy varying with the sample tested.

Characterisation of very small quantities of proteins by Van Slyke's method, N. NARAYANA and M. SREENIVASAYA (*Biochem. Jour.*, 22 (1928), No. 4, pp. 1135-1137; also in *Jour. Indian Inst. Sci.*, 12A (1929), No. 4, pp. 37-40).—The modification of the Van Slyke method (E. S. R., 26, p. 22) here described was carried out with samples of from 100 to 150 mg. of the protein. After hydrolysis, the excess acid was removed from the amino acid solution by distillation under reduced pressure at 40 to 45° C. The sirup remaining after the distilling off of the acid was made up to 40 cc. and the amide nitrogen removed from two 10-cc. portions by aeration after the mixture had been rendered just alkaline to phenolphthalein by means of $\pi/2$ alkali. The estimation of the basic amino acids was done by a micro-form of the usual method except that arginine was determined by hydrolysis with arginase in 5-cc. aliquots of the original digest, the ammonia having been first removed by aeration as above described and the reaction adjusted to pH 9.7 by the addition of a phosphate buffer mixture. Following the hydrolysis of the arginine with arginase, urease was added, the solution was adjusted to pH 7, and, following the action of the second enzyme, a slight excess of saturated potassium carbonate solution was added and the ammonia determined by aeration into standard acid as before.

The figures obtained in parallel trials of the micro-method and the regular procedure were, respectively, for ammonia nitrogen 9.90 and 10.12 per cent, for humin nitrogen 1.16 and 1.86, for arginine nitrogen 9.89 and 9.01, for histidine nitrogen 3.88 and 4.16, for cystine nitrogen 0.96 and 0.63, for lysine nitrogen 7.67 and 8.12, and for amino nitrogen and nonamino nitrogen in the filtrate from bases 59.20 and 57.30, and 9.02 and 9.10 per cent of the total nitrogen. Partial sets of comparison figures obtained in the analysis of gelatin are also shown.

In general, neither the micro-method figures of the authors nor their results by the regular Van Slyke procedure agree closely in all cases with those of the other investigators whose findings are quoted for comparison.

The determination of pyruvic acid, B. H. R. KRISHNA and M. SREENIVASAYA (*Biochem. Jour.*, 22 (1928), No. 5, pp. 1169-1177, fig. 1; also in *Jour. Indian Inst. Sci.*, 12A (1929), No. 4, pp. 41-51, fig. 1).—The method, described in detail, consisted essentially in the reduction, by means of a zinc-copper couple and sulfuric acid without heat, followed by the oxidation of the resulting lactic acid by neutral 0.01 or 0.005 N potassium permanganate. The acetaldehyde formed in this second reaction was estimated in the usual way.

The actual recovery of pyruvic acid as equivalent acetaldehyde was found to be very constantly 80 per cent of the theoretical. With the use of the factor corresponding to this yield the results on known quantities (from 3.05 to 15.37 mg.) of pyruvic acid added to protein solutions ranged from 97.6 to 100.2 per cent.

For the figures resulting from the analysis of 5 cc. of the body fluid of the lac insect, to which had been added 4.48 mg. of pure pyruvic acid, the probable error was found to be approximately 1.4 per cent.

It is claimed, with reference to the analysis of small quantities of biological fluids, that the new method is more specific than the previously existing procedures. Various theoretical considerations connected with the determination are taken up.

The analytical detection of the bleaching of wheat flour, H. JØRGENSEN (*Den Analytiske Paarvisning af Blegning af Hvedemel. Copenhagen: [Bage- og Mellaboratoriet], 1928, pp. 1-42; Eng. summary. pp. 43-70*).—Following the Danish text, practically the entire substance of the paper, with the exception of a brief foreword by S. P. L. Sørensen, is presented in a very full English summary, of which the contents are as follows: An introduction, taking up the topics of the pigmental matter present in wheat flour, the agents employed in the bleaching of wheat flour, the attitude of the authorities and legislation as to flour bleaching, and the object and plan of the present research work; section 1, on the elaboration of a method of determining whether flour is artificially bleached; section 2, on the elaboration of methods for deciding what bleaching agents have been employed upon a given sample of bleached flour; section 3, on examples of the employment in practice of the methods treated of in sections 1 and 2; section 4, in which are taken up the determination of gasoline color values, the detection of nitrous acid in flour due to bleaching with nitrogen peroxide, etc., the detection of chlorine due to bleaching with chlorine or its compounds, the detection of residues of other bleaching agents, and ordinary methods of analysis; and finally, concluding remarks, under which caption are noted the tests found sufficiently dependable to be recommended.

The system of examination as finally worked out is based primarily upon determinations of the gasoline color value of the flour. The manner of determining this value was changed from the customary one in two ways, however, the 0.05 per cent standard color solution of potassium chromate having been made up in a buffer solution (pH 5.6 phosphate) instead of in pure water, to avoid variations in the color of the standard with variations in the H-ion concentration likely to occur in a solution of potassium chromate in pure water, while the numerical value arbitrarily assigned to the color of the standard solution was set at 100 instead of at the usual value of unity.

The color value having been determined as described, it is concluded that if the gasoline color value be 90 or less the flour is to be declared bleached. It is noted, however, that "(1) only flour handled in rather large bags and not having been stored exceptionally long may be judged according to this rule;

(2) flour for gasoline color value determinations must be taken from the core of the bag; [and] (3) flour with an ash content of appreciably over 0.65 per cent has not been sufficiently investigated to give full surety of the above rule being applicable to such flour."

With regard to the nature of the bleaching agent, "if a chlorine content of 15 mg. or more is found in the fat of 1 kg. of flour, such flour may be declared to have been bleached with chlorine in some form. If the nitrous acid content of a certain flour proves to be 40×10^{-5} gm. or some greater value per kilogram, it is probable that the flour has been bleached with nitrogen peroxide, or some other bleaching agent that occasions the formation of nitrous acid."

The last two tests are given especially for flour showing color values of 95 or more when partial bleaching is suspected.

The determination of sulfurous acid in apple musts and ciders [trans. title], WARCOLLIER and LE MOAL (*Ann. Falsif.*, 22 (1929), No. 246, pp. 333-340).—In the case of the addition to apple juices or to ciders of relatively large proportions (from 200 to 1,000 mg. to the liter) of sulfurous anhydride, it was found that the Ripper method for the determination of the preservative (involving the alkalifying of the solution to break up organic combinations of the sulfurous anhydride) gave low results as compared with the Haas method.

The tannin content of the material having been suspected as the source of the discrepancies observed, solutions containing 10, 5, and 3 gm. to a liter, respectively, of a highly purified tannin were treated with sulfur dioxide and then were made alkaline and held in that condition for periods ranging from 5 to 60 minutes, after which the sulfurous anhydride content was determined. Appreciable proportions of the anhydride were found to have been destroyed in the shortest periods, and in the longer periods 90 per cent or more of the added sulfur compound had become no longer determinable as sulfurous anhydride. The action was found to be an oxidation, not a combination of the sulfur dioxide with the tannin. When tannin and sulfur dioxide were both added to apple juice and to ciders the tannin increased the rate of disappearance of the preservative from the alkalified mixture. In any case, the oxidation induced by the tannin could be observed only in alkaline solutions.

As conclusions bearing upon the practical determination of sulfurous anhydride in tanniferous fruit juices and related substances, it is stated (1) that in the use of the Ripper method not more than 5 minutes in an alkaline solution is necessary for breaking up organic combinations into which the sulfur dioxide may have entered; and (2) that only the Haas method gives absolutely accurate results.

The nature of the vitamin A constituent of green leaves, D. L. COLLISON, E. M. HUME, I. SMEDLEY-MACLEAN, and H. H. SMITH (*Biochem. Jour.*, 23 (1929), No. 4, pp. 634-647).—The authors have prepared, by the method described by E. Clenshaw and I. Smedley-MacLean,¹ the unsaponifiable material from the lipoids of green and white cabbage leaves and have determined the relative content of vitamin A in the two materials by biological tests in which the extracts were fed dissolved in hardened cottonseed oil.

The green leaves yielded from 3 to 4 times as much unsaponifiable matter as an equal weight of the white leaves, and its vitamin A activity was about 10 times that of the extract prepared from white leaves. On fractionation the vitamin A activity of the material from the green leaves appeared to be associated with the carotin-containing fractions and to be greatest in the most unsaturated fractions. Specimens of carotin were next obtained from green

¹ *Biochem. Jour.*, 23 (1929), No. 1, pp. 107-109.

cabbage, spinach, and carrots in crystals softening at 174 and melting at 178° C., 163 and 164, and 164 and 169°, respectively. In the specimens of highest melting point and presumably greatest purity there was no loss in activity, the dosage lying between 0.002 and 0.005 mg. daily.

In discussing these results, recent conflicting literature on the vitamin A activity of carotinoid pigments is reviewed, with the suggestion that "the crystals of carotin may themselves be homogeneous and active or that they may consist of two or more closely related substances, only one of which possesses vitamin A activity." The possibility is also suggested that more than one substance can function as vitamin A.

The technic followed in the feeding tests differed from that previously described by Hume and Smith (E. S. R., 60, p. 93) in that a preliminary depletion period was always used and the dosage was adjusted to that which would just sustain life over a definite period. Various difficulties involved in working with such suboptimal doses are recognized, however. In the course of the investigation evidence was obtained that marmite, the yeast preparation hitherto used almost exclusively by British workers as the source of vitamin B complex, could no longer be relied upon as a constant source of supply of vitamin B₂. This was corrected, first by a supplement of autoclaved dried yeast and later by the substitution of dried yeast for the marmite.

Some analytical remarks on the vitamin A, S. H. BERTHEM (*K. Akad. Wetensch., Amsterdam, Proc.*, 32 (1929), No. 5, pp. 667-668).—In this discussion of the antimony trichloride test for vitamin A, attention is called to three disadvantages in the method: "(1) The tintometer readings depend on the light. (2) The reaction mixture often becomes turbid. (3) The reaction is not quite specific." In the experience of the author the first difficulty can be overcome by the use of a daylight lamp suspended perpendicularly over the ocular of the tintometer, the light being reflected by a milk-glass pane placed in a vertical position at a distance of 25 cm. from the colorimeter tube. Turbidity on adding the antimony trichloride solution is prevented by the addition of a small amount, 0.02 cc., of acetic anhydride to the colorimeter tube.

The fact that certain substances give the color test but show no evidence of vitamin A is thought to indicate that there must be something in common or similar in the molecular structure of vitamin A and such substances. Of all the fats tested by the author, only those containing vaccenic acid (11-, 12-elaidic acid) contained vitamin A and in those giving negative color tests the acid could not be detected.

Since bixin in the form of annatto is used in coloring butter and other food products and carotinoids are present in a large variety of foods, it is considered that "all figures in literature regarding vitamin A contents of foods, oils, etc., estimated by the colorimetric method, must be considered with the utmost reserve, if not at the same time the presence of bixin and carotinoids is excluded." It is stated that bixin can be removed by saponification with alcoholic potassium hydroxide and subsequent dilutions with water and repeated extraction of the unsaponifiable matter. To exclude carotinoids it is recommended that parallel tests be made with phloroglucin and a few drops of concentrated hydrochloric acid which, according to S. Hamano², gives a color reaction with vitamin A but not with carotin.

It is noted finally that the eye is most sensitive to slight changes in intensity in colors not greatly exceeding 10 Lovibond blue units, and that the extract to be tested should be diluted to an extent that 0.1 cc. produces with 1 cc. of

² Jour. Agr. Chem. Soc. Japan, 4 (1928), No. 1, pp. 45-50.

the 30 per cent solution of antimony trichloride in chloroform about 10 blue units with the readings taken within 30 to 60 seconds.

Observations on the assay of vitamin A, J. C. DRUMMOND and R. A. MORTON (*Biochem. Jour.*, 23 (1929), No. 4, pp. 785-802, figs. 4).—This report of an extensive comparison of the reliability of the biological, colorimetric, and spectrographic methods of determining vitamin A should be consulted in the original for various recommendations concerning technic and interpretation of results, particularly in the biological tests. The investigation is summarized as follows:

The results in general show the unreliability of the biological test. Although from 7 to 12 animals were usually employed for each dose, the individual responses varied so widely as to make it difficult to detect quantitative differences in vitamin A potency of less than 100 per cent. The agreement between the results of the colorimetric and spectrographic methods was very close.

"In view of the statement of other investigators that certain oils (fish-body oils) may be rich in vitamin A without showing the color reaction, it seems still undesirable to claim that the colorimetric method can generally replace the tedious inaccurate biological tests. Actually, in a wide experience, we have not encountered a single instance in which there has been disagreement between the animal tests and the intensity of the blue color showing maximum absorption near 608μ . As far as cod-liver oils are concerned we have no hesitation in recommending the colorimetric and spectrographic methods as giving rapid and reliable quantitative results."

The colorimetric estimation of vitamin A, T. MOORE (*Lancet* [London], 1929, II, No. 5, pp. 219, 220).—In this discussion of the specificity of the antimony trichloride color test for vitamin A, recent contradictory evidence is reviewed briefly and the question is raised as to whether or not the production of a blue coloration of any shade is a sign of vitamin A activity. The findings of Von Euler and Karrer (*E. S. R.*, 62, p. 112) are thought to answer the question in the negative. Further evidence along the same line is presented in the discovery that the oxidation product formed when carotin in chloroform solution was treated in the cold with benzoyl peroxide was inactive physiologically, while the color value was unaltered. Spectrographic examination also showed that the absorption band attributable to carotin was no longer in evidence.

In the opinion of the author "for the present it seems safe to assume that materials which give no blue coloration with antimony trichloride, even after the removal of saponifiable matter, must be devoid of vitamin A activity. Materials of liver oil origin giving color reactions characterized by absorption at 610μ may be considered active. But, on the other hand, materials which give color reactions characterized by absorption at other positions may be either active or inactive, or mixtures of inactive and active chromogens, and the biological technic still remains the only satisfactory method of assay."

METEOROLOGY

Monthly Weather Review, [July-August, 1929] (*U. S. Mo. Weather Rev.*, 57 (1929), Nos. 7, pp. 277-316, pls. 6, fig. 1; 8, pp. 317-360, pls. 18, figs. 13).—In addition to detailed summaries of meteorological and climatological data and weather conditions for July and August, 1929, and bibliographical information, notes, abstracts, and reviews, these numbers contain the following contributions:

No. 7.—Climatologist's Round-the-World Voyage, by R. DeC. Ward (pp. 277-291); Reflectivity of Different Kinds of Surfaces, by H. H. Kimball and I. F. Hand (pp. 291-295); A Tentative Chart of Annual Rainfall over the

Island of Haiti-Santo Domingo (illus.), by O. L. Fassig (p. 296); A. Water-spout in Mobile Bay, July 27, 1929, by A. Ashenberger (pp. 296, 297); and L. H. Nichols on Meteorological and Forest-Fire Hazard Conditions in the Province of Quebec, by M. F. Burrill (pp. 297, 298).

No. 8.—The Flood of 1929 in the Lower Mississippi Valley, by R. E. Spencer (pp. 317-319); Weather Abnormalities in the United States, IV (illus.), by A. J. Henry (pp. 319-323); Some Characteristics of the Rainy Season at Tampa, Fla. (illus.), by W. J. Bennett (pp. 323-326); Change in Density of Snow Cover with Melting (illus.), by G. D. Clyde (pp. 326, 327); The Effect of Rain on the Snow Cover, by G. D. Clyde (p. 328); The Frequency of Tropical Cyclones (West Indian Hurricanes) That Closely Approach or Enter Continental United States (illus.), by A. J. Henry (pp. 328-332); The West Coast Atmospheric Fault (illus.), by E. H. Bowie (pp. 332-334); The Growth of the Vessel Weather Service of the Northeast Pacific Ocean, by W. J. Hutchison (pp. 334-336); Meteorological Needs of a Class A 1 A Airport, by D. M. Little (pp. 336, 337); What a Tornado Looks Like, by S. D. Flora (pp. 337, 338); and Pensacola Waterspout of June 14, 1929 (illus.), by P. G. Hale (pp. 338, 339).

Climatological data for the United States by sections, [July-August, 1929] (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 16 (1929), Nos. 7, pp. [200], pls. 2, figs. 5; 8, pp. [199], pls. 3, figs. 3).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for July and August, 1929.

Meteorological observations, [September-October, 1929], C. I. GUNNESS and D. F. MURPHY (*Massachusetts Sta. Met. Ser. Buls.* 489-490 (1929), pp. 4 each).—The usual summaries and notes are given of observations at Amherst, Mass., during September and October, 1929.

Meteorological report (*Montana Sta. Rpt.* 1928, pp. 54-59).—Data on temperature, precipitation, evaporation, wind, and cloudiness for 1928 and on the frost-free period, 1914-1928, at Bozeman, Mont., are summarized.

In general, conditions of temperature and precipitation in 1928 were favorable for growing and harvesting grain. The annual precipitation was 15.88 in., 2.29 in. below normal, but was well distributed. The total evaporation, April-October, was 39.07 in., 2.81 in. above normal. The mean annual temperature was 42.23° F., the highest 95° August 10 and 11, the lowest -24° February 23. The first killing frost occurred September 13, the last June 8. "The average frost-free period for 15 years at Bozeman is 103.1 days when the temperature of 32° or colder represents the dates of the first and last killing frost, but is 121.1 days when calculated from the actual dates of the first and last killing frosts." The number of clear days was 112.

Meteorological observations, A. BISSEBUP (*Virgin Islands Sta. Rpt.* 1928, pp. 19, 20).—Observations on temperature, rainfall, evaporation, and wind are summarized for each month of the year ended June 30, 1928. The total rainfall for the year was 46.91 in. as compared with 48.05 in. for the previous year. It was, however, well distributed for sugar production, the sugar crop being 12,000 tons in 1928 as compared with 7,000 tons in 1927.

SOILS—FERTILIZERS

Soil survey of Middlesex County, Massachusetts, W. J. LATIMER and M. O. LANPHEAR (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.]*, Ser. 1924, No. 26, pp. 58, fig. 1, map 1).—Middlesex County lies in the northeastern part of the State, extending from the New Hampshire line to the city limits of Boston. The county possesses an area amounting to 532,480 acres and has

topographic features of the central plateau of Massachusetts, of the eastern plateau, within the limits of which is included the greater part of the area surveyed, and of the Sudbury and Boston Basins, the surface ranging from nearly level to more or less mountainous.

Most of the small-stream bottoms and the tidal marsh along the salt streams are poorly drained. The upland, which comprises most of the county, is well drained with the exception of a few small areas.

The wide variety of the agricultural soils is indicated by the finding of 41 individual types here presented as 14 series. Of these Gloucester stony fine sandy loam, aggregating 11.8 per cent of the total area of the county, is the most extensive type, followed by Merrimac loamy sand, 8.8 per cent. Of the unclassified lands peat and muck, together amounting to 15.2 per cent, are the most extensive, although little utilized except as cranberry bog or drained and improved for market gardening.

The soil resources of Montana (*Montana Sta. Rpt. 1928, pp. 18-20*).—The progress of the reconnaissance soil survey, which has now covered about 25,000,000 acres, of which nearly 2,000,000 acres were examined during 1928, and of the detailed soil survey, of which 560,000 acres have been completed, is reported. The general character, the agricultural possibilities, and the problems of the soils found are discussed briefly. These surveys are being conducted in cooperation with the U. S. D. A. Bureau of Chemistry and Soils.

Heavy plains soil moisture problems, H. H. FINNELL (*Oklahoma Sta. Bul. 193 (1929), pp. 8*).—Following the warning that the more effectively "higher yields are forced from the land by tricks of increasing the moisture-using efficiency the quicker will the native fertility be reduced to a low point," it is concluded, under the caption of useful dry farming practices for heavy soils, that "contour tillage or level terracing saves run-off. The maintenance of organic matter promotes rapid absorption of moisture into the soil. Deep plowing for fertility improvement and returning vegetable matter should be done as long before planting as possible—when preparing to summer fallow is a good time. The fewest cultivations necessary to control weeds conserve best the moisture already held in the soil. Ironclad rotation is inefficient. Better successes and fewer failures result from planning the cropping system according to varying conditions. Fallowing should be used only when the subsoil is exhausted of available moisture. A store of moisture is more efficiently used during the first available crop season than saved over for a future crop.

"The moisture-using efficiency of early maturing grain sorghums is improved by late planting. Highest grain yields are insured from grain sorghums by varying the stand according to the amount of soil moisture available at planting time. Spring grains can best be omitted from the cropping system excepting when early spring moisture supplies are adequate. In order not to let any seasonable opportunities for production go to waste, equipment should be provided for small grains, row crops, and forage crops, and timely use made of them."

Soil experiment fields (*Kentucky Sta. Rpt. 1928, pt. 1, pp. 35-38*).—Field fertilizer and rotation tests of the usual sort are somewhat fully reported, with statements of treatment, yield, etc. Seven fields are mentioned.

Studies by the chemistry department (*Montana Sta. Rpt. 1928, pp. 37-39*).—One year's experimental work on the effect of phosphatic fertilizers on the yield and composition of forage plants grown on 10 fields in Gallatin County showed an average increase in the yield of 66 lbs. an acre with an increase in protein content averaging 6 per cent. In the case of alfalfa grown at Fromberg phosphatic fertilizer increased the yield 25.62 and 38.37 per cent and

increased the phosphate content of the first cutting 65 per cent, the second 43 per cent, and the third 32 per cent. The protein content of the hay was increased 10 per cent in the first cutting, though very little increase of this component appeared in the second and third cuttings. The results are considered suggestive only, but "they do, however, point to the possibility of increasing the yields and feeding value of forage crops by the use of a phosphate fertilizer, and are of special interest since Gallatin Valley is one of the most fertile valleys in the State."

The nitrification rate was found to be increased by manure applications. It was demonstrated also "that fallowed land always contains more available nitrogen than land cropped continuously or land growing a cultivated crop." The cultivated land, further, had always more available nitrogen than did land cropped continuously.

The protein content of wheat was found to be increased by adding to the soil nitrogen content through the application of manure or the plowing under of green crops.

Ammonium sulfate at 200 lbs. to the acre gave average yields of 42.8 bu. per acre on fertilized plats and 21.8 bu. on the check plats. The fertilized plats yielded wheat of a 16.13 per cent average protein content, while the crop from the check plats averaged 13.48 per cent protein. "Additional nitrogen in some form must be supplied to land cropped continuously to wheat if yields and protein content of the wheat are to be maintained."

Infertility, formerly attributed to "alkali" salts, has been found in many cases to be due rather to deficiency in nitrogen, phosphorus, or organic matter, or even to acidity.

A fertilizer study on the brown soil of the red prairies, H. F. MURPHY (*Oklahoma Sta. Bul. 188 (1929), pp. 7*)—General fertilizer tests of the usual type led to the conclusion, principally, that cotton is the only crop of which the yield on the soil under consideration can be increased enough by fertilizer treatment to pay a profit. Superphosphate could be applied with some profit to cotton either alone or in combination with manure or with manure and limestone, but limestone alone was applied at a loss.

Fertility studies on Kirkland soil, H. F. MURPHY (*Oklahoma Sta. Bul. 189 (1929), pp. 8*).—General fertilizer tests covering for the most part the usual field of such work were made on continuous wheat, on wheat in rotation with kafir and cowpeas, on a continuous culture experiment in which cotton, kafir, and oats were all continued each on its own soil, and upon alfalfa plats. In the test with alfalfa superphosphate with manure gave the highest net return, \$28.70 an acre.

The use of barnyard manure under semiarid conditions, H. H. FINNELL ([*Oklahoma*] *Panhandle Sta., Panhandle Bul. 10 (1920), pp. 14, figs. 3*).—The occasional injury to grain crops in the Panhandle Region, "due to an unbalanced relation between soil moisture and available fertility after manuring" having been observed, a study of the situation was made, the experiments leading to the conclusions, among others, indicated in the following statements:

"The additional moisture may be needed for the promotion of decay in the case of raw manure and crop residues, or for growth requirements of a crop supplied with excessive plant food in the case of well-rotted manure. Summer fallowing of manured land to restore a proper balance has been successfully practiced as preparation for the first crop after manuring, but the use of forage instead of grain crops to avoid reduction of yields makes this unnecessary. The data of five years' results show that the grain equivalent gain in yield per 50-bu. load of manure applied was 56.8 lbs. from continuous hay culture

and 69 lbs. from rotation crops. No instance of yield depression from manuring has been recorded where forage crops followed the application.

"Preliminary indications are that the effects of manure are extended over a longer period of time under the soil and climatic conditions represented here than elsewhere in Oklahoma. Variations in seasonable conditions may affect materially the size of gains secured from a given application of manure, but delayed use of it does not appear to cause appreciable waste."

Analytical studies on green manuring [trans. title], F. MARTIN (*Kuhn Arch.*, 12 (1926), pp. 146-204, figs. 4).—Following an extended presentation of his experimental data and a detailed discussion of these results, the author presents the conclusion that in considering the results of stubble green manuring it is necessary to distinguish clearly between the effects of this practice upon (1) the immediate yield and (2) the properties of the soil. The yield was definitely increased, as shown in the direct results of the cropping experiments cited; but according to the author's interpretation the soil conditions, at least in the surface soil, were as definitely impaired.

The following are listed as the factors contributing to increased yield: Enrichment of the soil with respect to humus, soil nitrogen, and phosphoric acid content, improvement of the water-holding power, and the evolution of carbon dioxide. Factors indicated as concerned in the impairment of the properties of the soil are: Impairment of the final state of the soil with respect to (1) the soil structure and (2) the bacterial activity; increase in acidity; impairment of the buffering power; and reduction of the lime content.

The paper is accompanied by extensive tables of analytical data (humus content, nitrogen content, rate of decomposition of the organic matter, calcium carbonate content, soil temperatures, acidity in terms of pH value, and buffering power, the figures covering in most cases both surface soil and subsoil conditions) and a bibliography of more than 100 items.

The nitrogen industries, L. MAUGÉ (*Les Industries de l'Azote. Paris and Liège: C. Béranger, 1929, pp. XLIV+684, figs. 255*).—An introduction deals with the nitrogen problem in a general way, taking up, among other subjects, the fixation of atmospheric nitrogen by natural and by artificial processes, and the liquefaction and fractional distillation of air as a source of nitrogen for fixation processes. Part 1, on the compounds of hydrogen and nitrogen, takes up the industrial production of hydrogen, the simultaneous preparation of hydrogen and nitrogen, the production of pure or technically pure nitrogen, ammonia and methods of obtaining it from organic sources, the direct synthesis of ammonia, ammonium salts, nitrides, and amido and other compounds. The second part, dealing with compounds of oxygen and nitrogen, takes up, following a short chapter on the general chemistry of oxygen and nitrogen compounds, the natural nitrates; the manufacture of nitric acid from sodium nitrate; the general equipment for the distillation, condensation, and handling of nitric acid; the direct synthesis of nitric acid; the synthesis of nitric acid by the catalytic oxidation of ammonia; oxidation and the absorption of oxides of nitrogen; concentration of nitric acid; and the industrial uses of nitric acid and the nitrates. The third part takes up the compounds of carbon with nitrogen, hydrocyanic acid and the cyanides, and calcium cyanamide. A fourth part gives physical constants and analytical procedures.

Test your soil for acidity, C. M. LINSLEY and F. C. BAUER (*Illinois Sta. Circ. 346* (1929), pp. 16, figs. 14).—According to the plan here described, 23 surface samples, 5 subsurface samples, and 5 subsoil samples are taken from a 40-acre field in accordance with a diagram given in the circular. Enough of each sample is placed in a 1- or 2-dr. vial to fill it to about one-third capacity, and a form of the Comber test solution (4 per cent potassium thio-

cyanate in 95 per cent alcohol is recommended) is added in quantity sufficient to bring the total volume to about two-thirds the capacity of the vial. After shaking the bottles and allowing them 10 minutes for settling, the colors are compared with a color chart given in the circular, which shows four degrees of intensity from colorless to deep red and is interpreted as indicating, respectively, no acidity or limestone requirement; slight acidity, requiring 2 tons of limestone to the acre; medium acidity, 3 tons; and strong acidity, 4 tons.

Outline acidity maps and maps showing the location and intensity of the soil acidity in zones of colors similar to those obtained in the test itself are shown, and the ease with which this method can be applied to the interpretation of the results of the test into terms of how much limestone to use, and where, is pointed out.

Commercial fertilizers in 1928-29 and their uses, G. S. FRAPS and S. E. ASBURY (*Texas Sta. Bul.* 403 (1929), pp. 50).—This is the usual report of fertilizer analyses and discussion of the use of fertilizers.

Commercial fertilizers, L. S. WALKER and E. F. BOYCE (*Vermont Sta. Bul.* 301 (1929), pp. 24).—It is noted in connection with the presentation of the usual analyses that 96 per cent of the brands licensed for sale in Vermont were of the "high-analysis" type, containing 14 per cent or more of total plant food, and that whereas the average price of the high analysis goods was but 30 per cent more than that of the low analysis products, the average plant food content was 60 per cent higher.

AGRICULTURAL BOTANY

Plant material introduced by the Office of Foreign Plant Introduction, Bureau of Plant Industry, October 1 to December 31, 1926 (*U. S. Dept. Agr., Inventory* 89 (1929), pp. 56).—During the period covered by this inventory of 911 items, the plant explorations of P. H. Dorsett in Manchuria were concluded. A large number of the introductions comprised soybeans, mung beans, barley, and wheat.

Grasses of Indiana, C. C. DEAM (*Ind. Dept. Conserv. Pub.* 82 (1929), pp. 356, figs. 328).—Descriptions, illustrations, and the known distribution in Indiana are given for 201 species and a number of varieties of native and introduced grasses. Appropriate keys are supplied for the tribes and genera, and excluded species are listed. Besides an article on The Grass Plant, by P. Weatherwax (pp. 21-28), the manual includes a glossary, an index, and a bibliography of Indiana grasses embracing 101 titles.

GENETICS

Textbook on breeding, C. KRONACHER (*Züchtungslehre*. Berlin: Paul Parey, 1929, pp. XVI+365, figs. 140).—The principles of Mendelian inheritance, including mutations and the inheritance of the various characteristics which have been identified in animals, are discussed in relation to the practical application of genetics to animal breeding. Part of the publication deals with animal nutrition.

Textbook of experimental zoology, B. DÜRKEN (*Lehrbuch der Experimental-zoologie*. Berlin: Borntraeger Bros., 1928, 2. ed., pp. XII+783, figs. 290).—This deals essentially with the principles of animal genetics, including the part which mutations and heredity play in evolution.

On some biological principles, C. G. J. PETERSEN (*K. Danske Vidensk. Selsk., Biol. Meddel.*, 7 (1928), No. 2, pp. 54).—A discussion of the principles

of biology considered in its broadest sense, including all phenomena, both material and psychical, concerning living organisms—plants, animals, and human beings.

The species problem in the light of genetics, J. B. S. HALDANE (*Nature* [London], 124 (1929), No. 3127, pp. 514-516).—The author classifies the causes of intraspecific differences under seven groups, namely, extranuclear factors or plasmons, single intranuclear factors or genes, multiple genes, differences in the arrangement of genes in the chromosome, differences in chromosome attachment, unbalanced differences in the amount of chromatin, and polyploidy, and finds that interspecific differences may be similarly grouped. He thus gives support to Darwin's hypothesis that differences between species are due to the accumulation of such smaller differences as distinguish varieties within a species.

Parallel cytology and genetics of induced translocations and deletions in *Drosophila*, T. S. PAINTER and H. J. MULLER (*Jour. Heredity*, 20 (1929), No. 6, pp. 287-298, figs. 8).—The authors discuss cases of chromosome translocations induced by X-rays and the correlation of the genetic behavior with the chromosome picture in cases of chromosome translocation, hyperploidy, deletion of X chromosomes, and chromosome breakage causing extra linkage groups. The possibilities of chromosome translocation and deletion in further genetic research are discussed.

The effects of aging of X-rayed males upon mutation frequency in *Drosophila*, B. B. HARRIS (*Jour. Heredity*, 20 (1929), No. 6, pp. 299-302, fig. 1).—Studies of the lethal mutations developing among the progeny produced by the offspring of X-rayed males mated with virgin females showed (1) that the percentages of mutations were similar from males which were mated from 0 to 4, 4 to 8, or 16 to 20 days after X-ray treatment; (2) that treated males mated continuously produced greater numbers of mutations in matings occurring up to 12 days after treatment; and (3) that the X-rays are more effective in inducing gene mutations and chromosome aberrations in mature spermatozoa than in immature male germ cells. The percentages of lethal mutations occurring in different regions of the X chromosome were shown to vary according to the location of the 5-unit section considered.

Visible mutations following radium irradiation in *Drosophila melanogaster*, F. B. HANSON and E. WINKLEMAN (*Jour. Heredity*, 20 (1929), No. 6, pp. 277-286, figs. 6).—An account is given of 49 germinal mutations which were induced by radium irradiation of males mated with double-X yellow females or by irradiation of a lethal-producing strain. Some of the mutations were sex-linked, while others were autosomal.

X-rays and somatic mutations, J. T. PATTERSON (*Jour. Heredity*, 20 (1929) No. 6, pp. 260-267, fig. 1).—Studies of mutations induced in *Drosophila* by X-rays have indicated that one of the main biological effects is the production of breaks in the chromosomes. Various practical uses of mutations induced by X-rays are suggested.

X-rays and parasitic wasps, P. W. WHITING (*Jour. Heredity*, 20 (1929). No. 6, pp. 268-276, figs. 3).—In studying the effects of X-rays on the parasitic wasp, both honey-fed and caterpillar-fed males and females were treated. Treated females were frequently sterile except for the production of a few offspring immediately after treatment and resulting from the practically mature eggs present. Females actively producing eggs as the result of caterpillar feeding seemed to be more likely to remain fertile. Honey-fed females may retain fertility if treated with weak dosages, though they frequently produced a few offspring and then became sterile. Treatment of mated females decreased the

ratio of females in the offspring, probably as a result of injury to the sperm in the seminal receptacles. Strong X-rays sterilized males, and weak dosages reduced their fertility. After treatment with weak dosages the fertility rose for a few days and then fell. One visible mutation was produced, though there was some evidence of the presence of lethals.

A new type of congenital hypodactylism of the front limbs occurring in the sixteenth to nineteenth generations of the descendants of X-rayed mice, H. J. BAGG (*Anat. Rec.*, 41 (1928), No. 1, p. 107).—The author describes the occurrence of new individuals with two digits of a front limb completely missing in the sixteenth generation of the descendants of X-rayed mice.

The effects of X-rays and radium on species of the genus *Nicotiana*, T. H. GOODSPEED (*Jour. Heredity*, 20 (1929), No. 6, pp. 243-259, figs. 16).—Abnormalities in cytological behavior, external morphology, and fertility induced in different species of *Nicotiana* by radiation with X-rays and radium in studies at the University of California are described and illustrated, with discussion of the variation of species in reaction to irradiation, the resistance of seeds and the susceptibility of seedlings to X-rays, and genetic changes in irradiated seeds.

Flexed tail, a mutation in the house mouse, H. R. HUNT and D. PERMAR (*Anat. Rec.*, 41 (1928), No. 1, p. 117).—A mutation in mice is described in which the tail is permanently rigid over a varying portion of its length. This characteristic was recessive to the normal, but the F_2 ratio obtained from crossing normals with flexed-tailed individuals was 6.9 to 1.

Linkage of the characters albinism and shaker in the house mouse, W. H. GATES (*Anat. Rec.*, 41 (1928), No. 1, p. 104).—The F_2 population obtained from crossing a pink-eyed, short-eared normal mouse with an albino shaker gave 187 colored nonshakers, 3 colored shakers, 10 albino nonshakers, and 54 albino shakers, and back crosses indicated a linkage of over 90 per cent. As the linkage between pink eye and shaker is weaker than between albinism and shaker, it appears that the gene for albinism lies between the genes for pink eye and shaker.

Four-strand crossing over, A. WEINSTEIN (*Anat. Rec.*, 41 (1928), No. 1, pp. 109, 110).—In a theoretical discussion it is pointed out that in maturation each chromosome is split lengthwise, but only two strands undergo interchange in crossing over. The number of points of crossing over in the original strands of a tetrad and in the emerging strands do not necessarily correspond with each other or with the number in the tetrad as a whole. A new formula is developed for calculating crossover frequency for strands or tetrads, giving crossover values different from those ordinarily calculated.

A cytological study of some iris hybrids [trans. title], M. SIMONET (*Bul. Mens. Soc. Natl. Hort. France*, 5. ser., 2 (1929), Aug., pp. 455-463, figs. 20).—Following an earlier paper on chromosome counts (*E. S. R.*, 61, p. 24), further information is presented on chromosomal behavior in the reduction division and in the maturation of the pollen mother cells.

Identity of genes and sex factors in intergeneric killifish hybrids, A. C. FRASER and M. GORDON (*Anat. Rec.*, 41 (1928), No. 1, p. 108).—Tests of the genes *R* and *Sp* in killifish have shown them to be stable sex-linked factors.

Hybrid vigor in poultry, D. C. WARREN (*Anat. Rec.*, 41 (1928), No. 1, p. 105).—In studies of hybrid vigor at the Kansas Experiment Station, White Leghorn and Rhode Island Red fowls were crossed in reciprocal matings. In the two purebreds the percentages of mortality to the age of three weeks were 5.6 and 6.3, respectively, but only 1.4 for the hybrids. The hybrids of both sexes outgrew the purebred offspring in both types of matings, but the cross of Leghorn male by Rhode Island Red female produced hybrids growing more

rapidly than those of the reciprocal cross. Females from the cross of Leghorn male by Rhode Island Red female were slightly slower in reaching maturity than White Leghorn females, while the females of the reciprocal cross were more nearly intermediate between the two purebreds.

A new hereditary factor in horses [trans. title], C. WRIEDT (*Hereditas*, 10 (1928), No. 3, pp. 274-276, figs. 2).—The author describes a factor in horses causing a distinctive white spotting which was a dominant modifier of gray.

Innate limitations of growth rate in the mouse, E. C. MACDOWELL, W. H. GATES, and C. G. MACDOWELL (*Anat. Rec.* 41 (1928), No. 1, p. 105).—Increases in the amount of mother's milk available to young mice and the maintenance of favorable conditions have made it possible to increase the rate of growth of individual mice for 14 days after birth, so that the growth curves are nearly smooth and rise to 15 gm., as compared with 4.5 to 7 gm. in published data. When age is counted from the anlage of the embryo, the curves approach a straight line on logarithmic paper. After 14 days a sudden break is associated with the first eating of solid food.

On the nature of hereditary size limitation.—I, Body growth in giant and pigmy rabbits, R. C. ROBB (*Brit. Jour. Expt. Biol.*, 6 (1929), No. 3, pp. 293-309, figs. 6).—The results of a statistical analysis of data on the postnatal body growth of Polish, Flemish Giant, and hybrid rabbits as furnished by W. E. Castle are reported.

These results indicate that the percentage rate of growth in all three groups is similar from the time of birth to the onset of puberty. The process of development differs, however, as the Polish rabbits are but half as large at the time of birth as the Flemish Giants, indicating the existence of some growth depressant in the former or some growth accelerator in the latter breed. The hybrid animals were almost as large at birth as the Flemish Giants and the growth curves approximated each other until the fourth month, when the hybrid animals showed a more rapid retardation of growth than the Flemish Giants. The lesser size of the Polish adult is ascribed to two factors, one effective during the placental period and causing the reduced birth weight, and the other effective during postnatal growth. Prior to the inflection point of the growth curve the hybrids are approximately as large as the Flemish Giants, but thereafter the retardation of growth resembles that of the Polish breed.

Deviations from the theoretical curves were noted in the three groups. The first is associated with parturition, and the second concurrent with the endocrine reorganization concerned with the thymus, testes, and suprarenal cortex. The adherence of the data to an integral curve descriptive of the autocatalytic chemical reactions is considered as not assuring the validity of the analogy.

Hereditary growth anomaly of the thumb, O. THOMSEN (*Hereditas*, 10 (1928), No. 3, pp. 261-275, figs. 23).—The author describes a hereditary thumb anomaly which has been observed in 14 unrelated families. It was due to the too early obliteration of the epiphyseal line.

The establishment of races of pigeons characterized by large or small thyroids, O. RMDLE (*Anat. Rec.*, 41 (1928), No. 1, p. 112).—In studies at the Carnegie Institution, four races of pigeons having a characteristically small thyroid and a like number of races of pigeons having large thyroids have continued through four to six generations and maintained their thyroid size at a characteristic level. It appears that crosses give F_1 birds having intermediate thyroid size.

Malignancy and inbreeding, L. C. STRONG, J. J. BITTNER, and A. M. CLOUDMAN (*Anat. Rec.*, 41 (1928), No. 1, p. 118).—The authors report that a type of carcinoma would not grow in the Bagg strain of albino mice, but after continuing the process of inbreeding transplantations of the tumor were successful

in 100 per cent of the animals, indicating a segregation of genetic factors making the individual susceptible to that type of tumor.

Eye defects in rabbits, H. L. IBSEN and L. D. BUSHNELL (*Anat. Rec.*, 41 (1928), No. 1, p. 110).—In an attempt to duplicate the work of Guyer and Smith (*E. S. R.*, 44, p. 566), 10 female rabbits were injected with rabbit antilens serum obtained from hens at the Kansas Experiment Station. In another experiment the eyes of the parents were needled. A total of 58 normal-eyed offspring were produced in the first experiment and 185 normal-eyed offspring in the second. There was one individual produced in the first experiment with a slight cloudiness at the base of the lens and one in the second experiment with a small spot on the surface of each cornea near the center of the pupil. Five individuals were produced in the normal stock during this time which had defective eyes much more noticeable than those observed in the treated stock.

Skin transplantation as a means of analyzing factors in production and growth of feathers, C. H. DANFORTH and F. FOSTER (*Soc. Expt. Biol. and Med. Proc.*, 25 (1927), No. 2, pp. 75-77, fig. 1).—Studies of the characteristics of the feathers developing on skin grafts in fowls indicate that the pattern and rate of feathering produced by the grafts follow the breed of the donor, but that the sex characteristics are in accordance with those of the host.

Gonad-stimulating hormone of anterior pituitary and heterosexual ovarian grafts, E. T. ENGLE (*Soc. Expt. Biol. and Med. Proc.*, 25 (1927), No. 2, pp. 83, 84).—In transplantation experiments of ovaries into castrated and entire male rats it was found that the success of the grafts depended primarily upon the vascularization of the area, while the development of follicles in ovarian grafts was dependent upon the presence of sufficient of the gonadal-stimulating hormone of the anterior pituitary body. Follicular development occurs in ovarian transplants in the castrated males but not in ovarian transplants into entire males unless additional amounts of the hormone of the anterior pituitary body are supplied, because in the entire animal the testis with its established circulation will utilize the hormone produced by the intact hypophysis.

FIELD CROPS

The influence of the combine on agronomic practices and research, J. H. MARTIN (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 7, pp. 766-773).—Cooperative investigations of combine harvesting by the U. S. Department of Agriculture and 13 State experiment stations during 3 years and observations elsewhere have shown how the combine has affected current agronomic practice and indicated its probable influence on future practice, especially in regard to type of farming, size of farm, tillage, double cropping, organic matter, the use of straw for feed, crop losses, crop varieties, moisture content of grain, weeds, and the culture of marginal lands. Agronomic problems concerning cropping systems, rotations, soil fertility, crop residues, and crop varieties which have arisen since the combine has come into general use are suggested for investigation.

Initial soil moisture and crop yield, H. H. FINNELL (*Oklahoma Sta. Bul.* 192 (1929), pp. 8).—The relationships of initial soil moisture to spring grain (oats), grain sorghum, and winter grain (winter wheat) was studied at the Panhandle Station during the period 1924-1928.

Although the climatic conditions do not favor spring grains very consistently, it seemed that these crops can be used very profitably when moisture is adequate in early spring. The omission of spring grains, except under favorable condi-

tions, is advised. The influence of initial moisture on the effectiveness of fall preparation for summer crops and in regard to the spacing of grain sorghums appeared sufficient to make it of value in planning. See also an earlier report (E. S. R., 61, p. 432).

Fall preparation is advised except when a severe drought exists at the contemplated time. Varying the planting rate for grain sorghums according to the soil moisture present at the time has given highly satisfactory results. With wheat, the initial moisture conditions were not found of great importance, except for the stand and overwintering without drought injury, and the limited data prevent a dependable forecast of crop results.

[Field crops experiments in Kentucky, 1928] (*Kentucky Sta. Rpt. 1928, pt. 1, pp. 16-18, 31-35, 43*).—The best grades of Burley tobacco and of dark tobacco were found to contain 30 and 20 per cent, respectively, more chlorine than the poor grades of these varieties. As an average, all good grades of these varieties contained 29 per cent more chlorine than the poor grades. Dark tobacco, all grades, averaged 209 per cent more than the corresponding grades of Burley, and different grades of dark tobacco contained about 10 per cent more sulfur than like grades of Burley. The chlorine content of tobacco fertilized with potassium chloride was almost in direct proportion to the quantity of chlorine applied in the fertilizer up to and including 400 lbs. per acre. An 800-lb. treatment resulted in further increase but at a reduced rate. In oven-dry material the chlorine rose from 0.048 per cent in unfertilized tobacco to 5.555 and 6.511 per cent in tobacco treated with 400 and 800 lbs., respectively, of potassium chloride. Potassium sulfate applications had little effect on the chlorine content. The percentage of sulfur rose with increasing applications but to a much lesser extent than chlorine, ranging from 0.4 per cent in untreated tobacco to 1.187 per cent in that receiving 800 lbs. of potassium sulfate. Early fall seedings of barley on plats which had grown tobacco during the summer were much more effective than wheat in removing nitrates from the soil and preventing loss in drainage water during the winter.

Sweetclover, white clover, and lespedeza seeded on bluegrass sod made better stands and growth on pastured than on unpastured areas. Although lespedeza did not mature enough seed for reseeding, it appeared to be much safer than the other two legumes for such use. Korean lespedeza suppressed bluegrass at the start, but the bluegrass in the next year made a practically solid stand. Redtop also largely suppressed the lespedeza, while lespedeza remained thick but did not injure the stand of orchard grass. The only red clovers to persist were those produced in the general latitude of Kentucky, and not all lots from this region were of value. Losses of stands in summer have been due largely to *Colletotrichum trifolii*.

Kentucky Bluestem wheat and also a strain each of Michigan Amber and Currell proved winter hardy in a winter when destruction was general. Fertilizers drilled in contact with wheat and hydrated lime in contact with oats did not harm germination or early growth. Wheat hand sown with calcium oxide was not injured in germination up to 1,500 lbs. per acre, which reduced germination about 10 per cent. Similarly, neither germination nor early growth was harmed where corn was planted in volumes of soil in which 4-10-6 fertilizers were distributed at rates of from 125 to 500 lbs. per acre.

Spring seeding of clovers and grasses at the Western Kentucky Substation at Princeton was very successful where limestone and superphosphate were used, poorer where raw rock phosphate was used, and practically a total failure where soil treatment was omitted. In a 3-year rotation of corn, wheat, and legume the average yield of corn on unfertilized checks seeded to a mixture of red and alsike clovers and lespedeza was 32 bu. per acre, while those treated

with limestone and superphosphate and the plot seeded to various clovers, including lespedeza, made 53 bu. Plots treated with superphosphate and seeded to lespedeza produced 34 bu. of corn, while a lot receiving limestone in addition made 50 bu.

[**Agronomic experiments in Montana**] (*Montana Sta. Rpt. 1928*, pp. 14-17, 21, 22, 49, 50).—Investigations with field crops at the station and substations reviewed as heretofore (E. S. R., 60, p. 729) were concerned with the improvement of wheat, oats, and barley, crop production under irrigation, seed control, seed problems, cultural methods, and forage production.

Winter wheat seeding tests showed that under Gallatin Valley conditions plantings before September 1 had very little smut, whereas wheat sown thereafter contained a high percentage of infected or smutted heads, probably due to temperature and soil relations existing at the different planting dates. Consequently it may be expected that for some seasons in which cool and moist conditions prevail during late August and early September seedings at this time may result in higher percentages of infection.

In the irrigated areas such perennial weeds as Canada thistle, field bindweed or wild morning-glory, quack grass, and Russian knapweed have become a serious menace to crop production in some localities. Certain chemicals were effective in killing the above-ground growth of Canada thistle and bindweed but failed to check the rootstocks. Sodium chlorate gave apparently favorable results in the Gallatin Valley, whereas carbon disulfide and a commercial herbicide did not give satisfactory control of the thistle and bindweed.

Field and laboratory tests (E. S. R., 60, p. 818) have indicated that frosted wheat which shows a strong germination of 70 per cent or more in laboratory tests will produce a good stand of wheat in the field. Hard-seed studies during 10 years showed that under no conditions is it beneficial to scarify alfalfa seed, whereas sweetclover seed is benefited by scarifying if it contains 50 per cent or more of hard seeds.

Trials of methods of preparing summer fallow for wheat at the Northern Montana Substation showed that the time of plowing is very important, and that when land is plowed early enough in the spring previous cultivation of the stubble is unnecessary. Duckfoot summer fallow has been very effective and nearly equal to plowed summer fallow for yield. During the past 11 years results showed that 8-in. plowing is superior to 4-in., and that while subsoiling for summer fallow slightly raises the yields such increase does not pay for the added cost. The hay of Ladak alfalfa, especially the first cutting, has been finer and superior to that of Montana common and Grimm. Spring rye and oats when seeded on fallow have given very excellent yields of good quality forage. Indications were that feed crops should be seeded early and on well-prepared land.

[**Agronomic investigations in the Virgin Islands, 1928**], M. S. BAKER (*Virgin Islands Sta. Rpt. 1928*, pp. 10-16, fig. 1).—Field crops experiments, continued as heretofore (E. S. R., 59, p. 432), included variety tests with sugarcane, grasses, soybeans, cowpeas, and sorghum; a spacing test and a fertilizer trial with sugarcane; and miscellaneous tests with forage and green manure crops.

In five cane crops, including two plant, two first ratoon, and one second ratoon, the varieties leading in average sucrose content per acre were in order P. O. J. 228, Uba 1241, P. O. J. 979, S. C. 22/31, B. 147, S. C. 12/4, B. H. 10(12), and P. O. J. 234. The merits of seedlings from different years are commented on briefly. The maximum average tonnages of cane for plant and two ratoon crops were made in hills 2 and 3 ft. apart in 3-ft. rows, 2 ft. apart in 4-ft. rows, and 2.5 ft. apart in 5-ft. rows. Seed pieces analyzing 8.5 per cent of sucrose

gave a germination of 75 per cent, whereas those containing 17.6 per cent sucrose germinated only 18.6 per cent, indicating that in a general way germinating quality is inversely in proportion to the sucrose content of the cutting. An artificial manure was similar to pen manure in its effect on yield of sugarcane.

Guinea grass, the principal source of feed for both dairy and work animals, has a high feeding value, even when cut in the dry season when partly cured and closely resembles hay. Guinea grass, Para grass, Merker grass, and Uba cane in order might be recommended for use as soiling crops.

[Cooperative experiments with field crops in Ontario] (*Ontario Dept. Agr., Agr. and Expt. Union Ann. Rpt., 50 (1928), pp. 8-35, 44-47, 49-53, 64-70*).—Papers of interest to agronomists presented at the fiftieth annual meeting of the Ontario Agricultural and Experimental Union at Guelph in January, 1929, included Cooperative Experiments in Field Husbandry in 1928, by W. J. Squirrell (pp. 8-32); Fertilizers, by R. Harcourt (pp. 32-35); Barberry Situation in Ontario, by J. E. Howitt (pp. 44-47); Legume Cultures, by D. H. Jones (pp. 49-53); and Research at Ontario Agricultural College, by G. I. Christie (pp. 64-70).

Crop improvement in Saskatchewan, M. CHAMPLIN and T. M. STEVENSON (*Saskatchewan Univ., Col. Agr. Ext. Bul. 44 (1929), pp. 55, figs. 33*).—The activities of various Dominion, provincial, and local agencies in the promotion of crop improvement in the Province are outlined, with descriptions of varieties of forage and cereal crops deemed best for northern prairie conditions.

Seed certification of cereals and legumes in Germany in 1927 and 1928 [trans. title], W. EDLER (*Züchter, 1 (1929), Nos. 2, pp. 40-59; 6, pp. 171-189*).—Resembling a similar report for 1925 (*E. S. R., 57, p. 133*), there are listed for the several divisions of Germany the areas of varieties and strains of cereals and legumes grown for seed and inspected for certification in 1927 and 1928. The tables show for 1928 totals of 20,372 hectares (50,339.21 acres) of 50 sorts of winter rye, 18,454 hectares of 122 sorts of winter wheat, 2,917 hectares of 27 sorts of winter barley, 41 hectares of 2 sorts of winter oats, 921 hectares of 3 sorts of spring rye, 2,684 hectares of 27 sorts of spring wheat, 9,569 hectares of 96 sorts of spring barley, 19,155 hectares of 102 sorts of spring oats, 170 hectares of 6 sorts of spelt, 28 hectares of 4 sorts of corn, 974 hectares of 32 sorts of peas, 25 hectares of 4 sorts of vetch, 369 hectares of 28 sorts of field beans, and 170 hectares of 12 sorts of lupines.

The technic of transplanting cereals, H. E. DÜBLIN (*Einführung in die Getreide-Umpflanz-Technik auf Grund Eigener Versuche und Beobachtungen. Berlin-Wilmersdorf: Reichsbund-Druckerei, 1928, pp. 29, figs. 10*).—An exposition of the principles and methods involved in the production of cereals by transplanting is supplemented by a brief review of earlier work on the problem.

Effect of date of seeding on yield, lodging, maturity, and nitrogen content in cereal varietal experiments, V. H. FLORELL (*Jour. Amer. Soc. Agron., 21 (1929), No. 7, pp. 725-731, fig. 1*).—A variety date-of-seeding experiment with wheat, barley, and oats in 1928 at the California Experiment Station in cooperation with the U. S. Department of Agriculture demonstrated that wherever the planting season extends over a wide period, as in California, the reaction of varieties in certain agronomic characters and nitrogen content of grain to each date of seeding is important and should be considered in planning varietal experiments.

Variations in potassium content of alfalfa due to stage of growth and soil type, and the relationship of potassium and calcium in plants grown upon different soil types, J. F. FONDER (*Jour. Amer. Soc. Agron., 21 (1929), No. 7, pp. 732-750, figs. 4*).—Stems and leaves and their juice from alfalfa plants

grown upon different soil types were analyzed at the Michigan Experiment Station for potassium at several growth stages, and other observations were made on various relations of potassium in the alfalfa plant.

Marked variations in the potassium content of the stems and leaves and of their juice were found due to soil type differences. The potassium percentages were highest in the plants grown upon the light sandy soils, medium in plants from very heavy soils, and least in plants from sandy loams. The potassium content of the plants did not appear to be an exact function of soil texture. More potassium was present in alfalfa stems than in the leaves, while about equal quantities were found in the expressed juice of these plant parts. The percentage of potassium in the stems and leaves and in their juice decreased decidedly with advance in growth. Potassium was present in about equal quantities in the plants of the first and second crops, and the potassium content of the soil apparently was not so depleted at any time that it controlled the potassium content of the plants. The element evidently was not an important cation in determining the specific gravity of the expressed juice of alfalfa stems and leaves, since an increase in the specific gravity usually occurred in spite of a decrease in potassium concentration in the juice.

The potassium in the green material of the alfalfa stems and leaves was largely in solution in the plant sap, and very little was held intimately in the woody tissue. Nearly equal quantities of potassium were in the woody tissue of the stems and leaves, although slightly more was deposited in the woody tissue of the leaves by the full bloom stage. In plants from some soil types increasing quantities of potassium were deposited in the woody tissue, while in plants from other soil types a decrease occurred during growth.

Within the alfalfa plants a physiological balance appeared to exist between potassium and calcium. An inverse correlation was established between these elements in plants from the different soil types, an increased calcium content being accompanied by a decreased potassium content, both at different growth stages and in the different plant parts. The potassium and calcium seemed to be interchangeable in the plants, although not necessarily alike functionally. The potassium content of the plants depended upon the calcium content, which in turn, according to indications, appeared to depend upon the available supply of calcium in the soil.

Fruiting habit of the cotton plant, T. S. BUE (*South Carolina Sta. Bul. 261* (1929), pp. 55, figs. 3).—The fruiting habits of the cotton plant (E. S. R., 58, p. 633) were the subject of investigation at Clemson College during the period 1923 to 1927.

In the first phase of the inquiry, 1923-1925, the fruiting habits of 20 varieties and strains of cotton were considered in groups of plants. A much larger percentage of flowers borne early in the season produced bolls than did those appearing later, and there were varietal differences. The flowering curves tended to rise rather slowly in the first two or three weeks and then rapidly, attaining the maximum about the fifth week, after which flower production gradually ceased. With other factors equal, a variety tending to produce much of its fruit early in the season seemed preferable to a cotton characterized by later fruiting. Cotton varieties differed markedly in flower production and also in ability to bear a large percentage of their flowers early in the season. Those sorts tending to produce many flowers early bore relatively few late in the season, and vice versa.

Slightly less than half of the flowers developed into mature bolls. The variation in this factor due to season was not enough to obscure the varietal differences. It was observed that varieties producing the most flowers very early in the season do not necessarily mature the most bolls per plant, since

a high shedding rate may offset this initial advantage. That shedding is influenced by soil moisture conditions was indicated by the higher shedding percentage in the very dry season of 1925. The number of bolls matured per plant did not seem to be a final criterion of yield, since greater size of boll and higher lint percentage may give a distinct advantage to a cotton developing fewer bolls. The maturation period of the boll varied with seasons and also within the same season and was prolonged progressively as the season advanced. The drought in 1925 appeared to shorten the mean boll period of all sorts from 10 to 15 days, but varietal differences were not wholly eliminated.

The multiple correlation coefficient, $R=0.86\pm0.06$, indicated that relative earliness of appearance of first flower, earliness of first open boll, flowering interval in days, and mean boll period determine largely (74 per cent) the earliness of crop, as measured by percentage of total yield obtained at first picking. The two latter factors evidently were the much more effective. The relative earliness of appearance of first flower and the percentage of total flowers produced during the first three weeks of flowering did not appear to be of great value in predicting the production in open bolls per plant.

In the second phase of the work, 1925-1927, individual plants of six varieties were studied to observe variation of plants within a variety and also the effects of heritable and environmental factors on the production and development of fruit buds. The fruiting of average plants of each variety showed that few upper branches bore flowers and fewer still produced bolls. Seasonal and varietal differences were apparent, and a varietal difference in the position of maximum fruiting also was observed. A variety may produce a greater proportion of its fruit on the lower branches than another cotton and at the same time may be able to retain and develop into open bolls more of the fruit borne in this zone.

The several varieties also differed in their ability to retain squares and young bolls, Lightning Express developing an average of 22.9 per cent of all squares into open bolls and Deltatype Webber maturing only 17.4 per cent. Cleveland developed a larger proportion of the fruit borne on the upper branches than did any other variety. Plants within the same variety varied widely in ability to retain and develop fruit into open bolls, suggesting the possibility of selecting plants with a short boll period for breeding purposes.

In mean boll period significant differences were noted between plants within a variety and also between averages for varieties grown under like conditions. Seasonal variations, while very obvious in effect on length of boll period, did not mask completely varietal and plant differences. The mean square period varied less than the mean boll period, which evidently was more subject to seasonal differences. The length of square and boll periods for the same fruits were correlated only slightly.

Proceedings of the fifteenth annual meeting of The Potato Association of America (*Potato Assoc. Amer. Proc.*, 15 (1928). pp. 5-18, 27-49, 62-87, 101-122, 129-169, 179-245, 327-377. figs. 11).—The fifteenth annual meeting of the association, held in New York City in December, 1928, is reported on, and the activities of the organization and of its committees in 1928 are summarized. The papers presented include several abstracted below, together with the following: President's Address, by F. M. Harrington (pp. 5-7); The Ventilation of Seed Potato Warehouses, by K. P. Bemis (pp. 7-11); Effect of Different Storage Temperatures on the Vitality of Seed Potatoes, by W. Stuart and P. M. Lombard (pp. 12-14) (*E. S. R.*, 61, p. 635); The Effect of Length of Storage on the Type of Sprouting of Potatoes, by J. Bushnell (pp. 15-18) (*E. S. R.*, 61, p. 32); The Effect of National and State Activities on Marketing the Potato Crop, by W. A. Sherman (pp. 27-36); Marketing Long Island Potatoes,

by H. R. Talmudge (pp. 36-41); Practical Aids in Marketing New Jersey Potatoes, by W. W. Oley (pp. 41-46); The How and When of Marketing Certified Seed, by J. W. Boulter (pp. 46-49); The Deterioration of Corrosive Sublimate in Solutions as Applied to Treatment of Seed Potatoes in Prince Edward Island, by R. R. Hurst and J. L. Howatt (pp. 62-70); The Effect of Seed Treatment on Black Leg, by J. Tucker (pp. 71-73); The Value of Organic Mercury Compounds for the Control of Seed Borne Scab and Rhizoctonia, by W. H. Martin (pp. 73-87); Potato Seed Treatment Studies on Long Island with Special Reference to the Organic Mercurials, by E. E. Clayton (pp. 101, 102); Seed Potato Treatments for Rhizoctonia Conducted in Northeastern Maine from 1925 to 1928, by E. S. Schultz, L. O. Gratz, and R. Bonde (pp. 102-112); The Potato Our Best Food Staple, by J. H. Kellogg (pp. 113-122); Potatoes in Their Most Palatable Form, by A. A. Walter (pp. 129-137); The Tuber Index Method of Seed Potato Improvement, by W. Stuart (pp. 138-140); The Tuber Index Method in Relation to Seed Potato Certification, by H. O. Werner (pp. 140-150); The Need of a More Rational Basis for Certification, by R. W. Goss and H. O. Werner (pp. 150-155); Special Seed Plot Methods and Their Values in the Red River Valley, by E. M. Gillig (pp. 155-160); Raising Certified Bliss Triumph Potatoes in New Brunswick, by C. H. Godwin and D. J. MacLeod (pp. 160-163); Yields of Northern Certified Seed Potatoes in Florida, by L. O. Gratz (pp. 164-169); Experimental Spraying and Dusting in Aroostook County, by R. Bonde (pp. 170-179); Breeding for Phytophthora Resistance, by D. Reddick (pp. 179-186); Production of Elite Potato Seed Stock, by J. E. Kotila (pp. 187-199); Viroses or Degeneration Diseases of Potatoes in the Northwest, by H. E. Morris (pp. 199-203); Recent Potato Virus-Disease Information Contributing to the Production of Better Seed Potatoes, by E. S. Schultz and D. Folsom (pp. 203-227); The "Leaf Index" of Some American Potato Varieties, by F. A. Krantz and A. E. Hutchins (pp. 228-235); and Controlling Size of Potato Tubers, by C. C. Starring (pp. 235-245).

Papers presented at the meeting of the Pacific Northwest Potato Growers Association at Spokane, Wash., in November, 1928, include Diseases of Potatoes, by T. M. Raeder (pp. 327-332); Tuber Index Work, by F. M. Harrington (pp. 332-338); Early Potato Varieties and Main Crop Production in the Yakima Valley, by H. Jensen (pp. 341-347); Certified Seed Potato Buying and Selling Pools in the United States, by C. P. Close (pp. 349-357); Uniform Standards as They Apply to the Marketing of Potatoes, by W. A. Schoenfeld (pp. 357-365); Potato Certification in British Columbia, by H. S. MacLeod (pp. 365-372); and Results of the Mount Vernon [Washington] Test Plots, by H. R. Vercler (pp. 372-377).

Potato varieties immune to wart disease and those susceptible varieties which are readily confused with them, K. SNELL (*Krebsfeste Kartoffelsorten und die Häufig mit Ihnen Verwechselteten Anfälligen Sorten. Variétés de Pommes de Terre Résistantes à la Galle Verruqueuse et Quelques Variétés non Résistantes Fréquemment Confondues avec Elles. Berlin: Paul Parey, 1929, pp. [60], pls. 24*).—Designed to aid in determining the identity and purity of potato varieties immune to wart disease, the flower, leaf, tuber, flesh, and sprouts of a number of important sorts are illustrated in color and are described in German, French, and English.

Influence of rotting seed-pieces upon the yield of the potato plant, F. E. DENNY (*Potato Assoc. Amer. Proc.*, 15 (1928), p. 61).—In the course of experiments noted earlier (*E. S. R.*, 60, p. 816), observations suggested that while the mother tuber contributes to the growth of the potato plant in the early stages of growth it may become a source of injury if it rots in the later stages of development

Effect of different hydrogen ion concentrations upon the yield of potatoes, P. H. WESSELS (*Potato Assoc. Amer. Proc.*, 15 (1928), pp. 245-250, fig. 1).—Lime and sulfuric acid were applied to potato plats at the Long Island Vegetable Research Farm of the New York Cornell Experiment Station to develop a series with reactions covering the range pH 4.4 to 6.6. Results in 1928 and 1927 with Irish Cobbler indicated a decline in yield as the reaction became less acid than pH 5.7. So far as yields are concerned, a reaction just acid enough to control scab seemed best. Determinations on a number of Long Island potato fields showed that scab is seldom serious where the reaction is more acid than pH 5.3. The cooking quality of potatoes grown on a quite acid soil was decidedly inferior to that of the ordinary run of potatoes in that section grown on soil with a reaction between pH 4.9 and 5.3.

The use of thiourea for controlling tuber size of potatoes, H. O. WERNER (*Potato Assoc. Amer. Proc.*, 15 (1928), pp. 88-100, figs. 7).—Seed potatoes of several varieties were treated after cutting at the Nebraska Experiment Station and three substations with solutions of thiourea from 0.25 to 4 per cent in concentration. The treatment did not retard emergence except when relatively strong—2 per cent or more—solutions were used. It increased the number of stems and number of tubers per plant but resulted in a general decrease in tuber size. Rinsing the sets after treatment greatly reduced the effectiveness of thiourea. Thiourea did not seem to lose any of its characteristic effects on potatoes when added to a hot formaldehyde solution. The optimum strength of solution appears in the range 0.5 to 1 per cent.

Concentrated fertilizers for potatoes, B. E. BROWN (*Potato Assoc. Amer. Proc.*, 15 (1928), pp. 250-259).—The relative merits of concentrated fertilizers for potatoes were studied by the U. S. Department of Agriculture in cooperation with the Maine, New Jersey, New York Cornell, Pennsylvania, and Virginia Truck Experiment Stations.

The fact that in some sections concentrated fertilizers have equaled and sometimes surpassed ordinary strength fertilizers, while in other localities results have been variable but generally in favor of ordinary strength formulas, suggests that the use of the concentrated material will depend on environmental and cultural factors. Their economic advantages must be weighed against their effect on the germination, growth, and final yield of the crop. Concentrated fertilizers should possess a proper physical condition to insure satisfactory drilling with the fertilizer distributing machine of the potato growers. They must be applied in such a way that they can not come in direct contact with the set, particularly on light, sandy soils.

Studies in time and rate of irrigating potatoes in Colorado, W. C. EDMUNDSON (*U. S. Dept. Agr., Tech. Bul.* 118 (1929), pp. 22, figs. 10).—During the years 1919 to 1925, inclusive, Rural New Yorker No. 2 receiving water as needed for vigorous growth throughout the growing season at the Colorado Potato Experiment Station at Greeley, averaged 313.2 bu. per acre, when plants assumed a dark green color 290 bu., and when the first water was withheld until growth was checked 236.4 bu. The percentage of prime tubers also increased with the early irrigations. Similar trends were observed with the Peerless (Pearl) variety during 1919, 1920, and 1921.

Both of the practices, irrigating the land before planting and irrigating up the newly planted crop, appear to have resulted in higher germination and increased yields. Yields of potatoes from plants receiving light irrigation differed little from those from plants given heavy applications with each watering.

Contact frosts in potato shipments, J. TUCKER (*Potato Assoc. Amer. Proc.*, 15 (1928), pp. 21-26, figs. 3).—Inspections in the field and at storages and car inspections on a commercial basis, according to this contribution from the

Central Experimental Farm, Ottawa, indicate the great care necessary in handling potatoes during winter to protect stock at every point from frost injury. At least two or three additional layers of potatoes next to those showing external frost injury should be removed when reconditioning frosted potato shipments. Contact with metal, icy loading platforms, frozen fuel, and the bottom and sides of cars may result in a serious chilling not readily apparent unless tubers are cut. Close examination of the tuber surface may reveal the point of contact where the under cooling commenced. The temperature of potatoes in storage during the rest period may rise and fall from the normal freezing point for the variety without injury to the tubers if the change takes place very slowly. Potatoes subjected to rapid temperature changes, however, are much more susceptible to chilling injury.

Storage of cut seed vs. whole seed, J. S. GARDNER (*Potato Assoc. Amer. Proc.*, 15 (1928), pp. 18-21).—Observations during seven years under practical conditions in Kentucky showed that where storage temperatures drop below the established minimum chilling affects cut seed more than whole seed. Whenever rot occurred in seed potatoes in cold storage, from whatever cause, the cut seed was much more affected than seed stored whole. Brine drip from broken coils in the storage rooms and also rain water splashing in through open ventilators were seen to affect cut seed worse than seed stored whole. Cut seed was observed to lose from 4 to 6 per cent in weight in cold storage as against from 1 to 3 per cent in seed stored whole. While differences in previous cellar storage conditions may upset the relation slightly, the whole stored seed have shown a consistent superiority in yield over seed stored cut.

Further experiments on chemical treatments for dormant potato tubers, F. E. DENNY (*Potato Assoc. Amer. Proc.*, 15 (1928), pp. 60, 61).—Additional tests (E. S. R., 59, p. 828) showed that tubers of Bliss Triumph and Irish Cobbler harvested from green vines, about two or three weeks before maturity, responded to treatment with both ethylene chlorohydrin and sodium thiocyanate. Ethylene chlorohydrin resulted in quicker sprouting, but sodium thiocyanate gave a better percentage germination. Great Scot, King Edward, and Burbank were not very dormant, even when freshly harvested, but the treated lots sprouted earlier; Beauty of Hebron was fairly dormant, and marked gains came after the treatments; and Bliss Triumph and Ehnola were dormant and responded promptly to treatments with both chemicals. Irish Cobbler, Green Mountain, and Peerless Pearl were the most deeply dormant of the varieties tested. Of these, the best response was obtained with Irish Cobbler, the treated lots giving plants 2 ft. high bearing a small second crop of tubers before sprouts from the untreated pieces showed above ground. The germination of Green Mountain was hastened by the treatments, but not all tests were completely satisfactory, and the tests with Peerless Pearl up to one month after digging were not successful. Bliss Triumph tubers dug from mature vines on August 9, treated August 13 to 15, and replanted on Long Island showed sprouts above ground on September 1. Excessive rotting was avoided by treating in potato crates and storing the dipped potatoes in stacks covered with builder's paper and canvas.

The availability of nitrogenous fertilizers to rice, R. P. BAETHOLMEW (*Soil Sci.*, 28 (1929), No. 2, pp. 85-100).—Comparisons of nitrogenous fertilizers for rice at the University of Arkansas showed that taking ammonium sulfate as 100 the efficiency of Leunasalpeter was 96 per cent, a mixture of cottonseed meal and ammonium sulfate 96, urea 92, sodium nitrate 89.5, blood meal 87, ammonium phosphate 84.5, calcium cyanamide 69.5, a mixture of cottonseed meal and sodium nitrate 66, cottonseed meal 61.5, and calcium nitrate 59 per

cent. Under proper conditions the first six seemed well adapted for rice production, although the ammonium compounds, such as ammonium sulfate and ammonium phosphate, appeared the better because rice seems to be affected less by the changes they produce and less nitrogen may be lost by denitrification.

The merits and demerits of organic nitrogen carriers and sodium nitrate, nitrate production, and loss of nitrogen are also commented on.

Relation of calcium to the nodulation of soybeans on acid and neutral soils. W. A. ALBRECHT and F. L. DAVIS (*Soil Sci.*, 28 (1929), No. 4, pp. 261-274, pls. 3).—The beneficial effects of liming for establishing thorough inoculation of legumes on acid soils, according to results of a study at the University of Missouri, may be due partly to the calcium as well as to the change in degree of acidity.

Application of calcium carbonate on an acid soil already well inoculated with the *Bacillus radicola* of soybeans gave a decidedly better inoculation of soybeans. Addition of calcium chloride to an acid soil, sterile to the soybean organism, favored its longevity from the time of introduction and improved inoculation on a later planting. A part of the root system of soybeans growing in soil treated with calcium had better inoculation than the part of the same root system growing in calcium-deficient soil. Evidently this effect was not transmitted readily to roots in media deficient in calcium but supplied with the necessary organisms. An increased content of calcium within 10-day-old soybean seedlings improved their inoculation when they were transplanted into acid soils. The soybean organisms in colloidal clay suspensions were carried down when flocculated with calcium chloride but not significantly when flocculated with potassium chloride. The effect of calcium in stimulating inoculation was not found to be related significantly to the H-ion concentration or the electro-dialyzable calcium in the soil in the few cases studied. In field trials very small quantities of calcium, applied as different salts, aided very effectively in increasing inoculation on certain soils but was hardly significant on others.

Soybean hay and seed production. W. J. MORSE (*U. S. Dept. Agr., Farmers' Bul.* 1605 (1929), pp. II+13, figs. 7).—Methods are outlined for cutting, curing, and baling soybean hay, and for harvesting, curing, threshing, and storing of soybeans for seed. Grading and marketing are discussed briefly. This publication supersedes Farmers' Bulletin 886 (*E. S. R.*, 38, p. 237).

Sweet potato production and handling. H. C. THOMPSON (*New York: Orange Judd Pub. Co.; London: Kegan Paul, Trench, Trubner & Co., 1929.* pp. 127, pls. 10, figs. 3).—This book gives a practical account of cultural and field practices involved in sweetpotato production, varieties, harvesting, storing, and marketing the crop, and on diseases and insect pests. A bibliography of 74 selected references is appended.

The production of cigarette tobacco by flue-curing. F. J. F. SHAW and K. RAM (*Agr. Research Inst., Pusa. Bul.* 187 (1928), pp. [3]+19, pls. 8).—Practical information on the cultivation and flue curing of Adcock tobacco is presented, with discussion of returns from growing bright tobacco in Bihar. In spite of the additional cost of flue curing, the net profit per acre at Pusa was greater than from indigenous tobacco cured by the local method.

The influence of fallow on yield and protein content of wheat. E. BURKE and R. M. PINCKNEY (*Montana Sta. Bul.* 222 (1929), pp. 19, figs. 6).—Wheat grown on fallow produced higher yields and the grain contained a higher percentage of protein than wheat grown on land cropped continuously. Yield and protein content were increased further by cultivating the fallow. The fallowed lands contained more moisture and nitrate nitrogen, evidently attributable to the practice of fallowing, and reflected in the higher grain

yields and protein content. Conservation of moisture by fallowing was a more significant factor at Forsyth, where the precipitation was lower, than at the station.

The application of statistical methods to seed testing, G. N. COLLINS (*U. S. Dept. Agr. Circ.* 79 (1929), pp. 18, figs. 2).—Possible applications of some of the simpler formulas are indicated to the seed analyst for use in measuring the accuracy of his various determinations.

Harrowing to control weeds in cereals [trans. title], S. DEUTJIS (*Meddel. Centralanst. Forsökar. Jordbruksområdet [Sweden]*, No. 348 (1929), pp. 23; *Eng. abs.*, pp. 22, 23).—Cooperative studies by Bolin in weed control by cultivation (*E. S. R.*, 54, p. 239) were continued to include 1927.

One harrowing to control weeds in grain resulted in an average increase of about 5 per cent in grain yield over no treatment, and a second harrowing gave an additional increase of about 3 per cent. The increase in straw yield was slight. Sometimes harrowing for weed control resulted in a noticeable decrease in yield, especially where the stand was sparse before harrowing or the crop was advanced too far in growth.

The eradication of weeds by chemical agents, W. C. HOPPER (*Sci. Agr.*, 10 (1929), No. 2, pp. 128-135).—Experiments in the control of annual, perennial, and lawn weeds by chemicals are reviewed briefly.

HORTICULTURE

[**Horticultural investigations at the Kentucky Station**] (*Kentucky Sta. Rpt. 1928*, pt. 1, pp. 29, 30).—Loss of leaves from peach trees following excessive spring rains is ascribed to excessive soil water, since comparable trees on well-drained sites suffered little or no defoliation. Differences in size at time of planting Elberta peach trees had little influence on subsequent growth or production; in fact, the smaller trees are deemed more satisfactory, being easier to prune and shape. Comparing winter, summer, and combined winter and summer pruning, no significant effects were noted on tree size or production. Fruit thinning studies conducted on separate limbs of 14-year-old Carman, June Elberta, and Hiley trees indicated that for early varieties thinning should not be done much later than 42 days after blooming. At 57 and 74 days following blooming there was noted a marked reduction in size gain over checks.

Among raspberries the Quillen black showed high resistance to anthracnose, and the Latham and June red varieties were found promising.

[**Horticultural investigations at the Montana Station**] (*Montana Sta. Rpt. 1928*, pp. 29, 30).—A brief progress report (*E. S. R.*, 60, p. 737).

Studies of the cause of celery plants shooting prematurely to seed suggested that temperature during the transplant stage is a vital factor in this phenomenon. Pruning and staking of tomato plants favored early maturity, differences of from two to three weeks being secured from these practices alone.

[**Horticulture in the Virgin Islands**], J. B. THOMPSON and C. L. HORN (*Virgin Islands Sta. Rpt. 1928*, pp. 5-10, figs. 2).—Yields taken on a plot of Cavendish bananas during the period July, 1927, to June, 1928, showed the highest monthly yield by weight in December, although there was no consistent seasonal trend. Papaya trees proved very short lived because of insect and fungus attacks. A lath propagation house assisted materially in increasing various economic and ornamental plants for distribution.

In cooperation with the municipal government of St. Croix experimental plantings were made of tomatoes, eggplants, peppers, and Bermuda onions for shipment to New York City. The tomatoes gave the most favorable results.

Notes are presented on various economic and ornamental plants composing an arboretum and on a test planting of figs. It is concluded that the fig is fairly well adapted to St. Croix, but that the pustule scale must be controlled to make fig growing successful.

Practical vegetable culture, A. E. WILKINSON (*New York: A. T. De La Mare Co., 1929, pp. VIII+300, pl. 1, figs. 124*).—A handbook designed primarily to assist the home gardener, vocational student, and beginners in gardening.

The family vegetable garden, W. B. NISSLEY and J. M. HUFFINGTON (*Penn. State Col. Ext. Circ. 120 (1929), pp. 49, figs. 23*).—Information of a general nature is given on the planning and care of the home garden.

Dehydrating Jerusalem artichokes, P. F. NICHOLS (*Fruit Prod. Jour. and Amer. Vinegar Indus., 9 (1929), No. 3, pp. 71-74, figs. 6*).—A brief popular report upon experiments at the University of California upon the cleansing, peeling, and drying of Jerusalem artichokes.

Onion trials in 1928, J. DOUGLASS and R. THOMSON (*Agr. Gaz. N. S. Wales, 40 (1929), No. 6, pp. 439-448, figs. 6*).—Brief reports are presented on varietal and cultural tests with onions in various localities in New South Wales. At the Bathurst Experiment Farm yields ranged from over 6 tons down to approximately 3 tons per acre. Under irrigation yields were notably increased. Phosphatic fertilizers gave generally beneficial results. Early seeding gave the largest yields, but in the earliest case apparently increased the tendency to shoot to seed.

Nursery practice, P. KACHE (*Die Praxis des Baumschulbetriebes. Berlin: Paul Parey, 1929, pp. XII+543, figs. [211]*).—This is a comprehensive discussion of the entire nursery enterprise, including plant materials, soils, methods of seeding, budding, grafting, pruning, culture, digging, packing, etc.

The use of certain materials and preparations as repellents against rabbits, T. J. MANEY (*Iowa State Hort. Soc. Rpt., 63 (1928), pp. 77, 78*).—On placing a rabbit in an inclosure with 3-year-old nursery trees, the trunks of which were painted with various materials, it was observed that rabbit blood, lime sulfur, and white lead paint were not effective in preventing injury, although certain proprietary materials apparently were. Apple, pear, sour cherry, and native plum barks were eaten freely, while that of the peach was untouched.

Some experiences in the use of tree wound dressings, T. J. MANEY (*Iowa State Hort. Soc. Rpt., 63 (1928), pp. 75-77, pl. 1*).—Applying various paints in June to the unwounded and freshly wounded surfaces of the trunks of 14- and 3-year-old apple trees, the author found marked variability in results. The younger trees were injured and in one case killed by complete painting of the unwounded trunks with certain of the materials. The older trees failed to show any outward injury of unwounded bark. None of the materials caused injury or retarded growth at the edges of the wounds but did in some cases kill the exposed cambium.

Orchard and small fruit culture, E. C. AUCHTER and H. B. KNAPP (*New York: John Wiley & Sons; London: Chapman & Hall, 1929, pp. XVII+584, figs. 278*).—Designed primarily for use in collegiate teaching of deciduous fruit growing, this volume discusses actual managerial and various practical operations, such as spraying, pruning, fertilization, propagation, harvesting, and packing in a manner suitable for the fruit grower, particularly to assist him in understanding the fundamentals that underlie his operations.

Varieties of fruits for West Virginia, H. E. KNOWLTON (*West Virginia Sta. Bul. 222 (1929), pp. 40*).—Descriptive and other notes are presented on varieties of apples, pears, peaches, plums, and cherries commonly grown in West Vir-

ginia, supplemented with recommendations concerning the interplanting of varieties to secure adequate pollination.

Pruning young fruit trees, R. E. MARSHALL, H. A. CARDINELL, and H. D. HOOTMAN (*Michigan Sta. Circ. 127 (1929)*), pp. 32, figs. 24).—A general discussion of the principles and practices of pruning young fruit trees at the time of setting and during the prefruiting period.

At the Graham Horticultural Experiment Station comparisons of none, light, and heavy pruning during the nine years following planting upon Duchess (Oldenburg), Grimes, Baldwin, Stayman Winesap, and Northern Spy apple trees showed pruning to reduce growth directly in proportion to the severity of the treatment. However, varieties responded differently to pruning; Grimes, for example, did not suffer as severely as the other varieties. The initiation of fruiting was not retarded by pruning, but the largest crops were produced on the nonpruned trees.

Pruning apple trees in Illinois, R. S. MARSH (*Illinois Sta. Circ. 349 (1929)*), pp. 16, figs. 11).—Starting with 1-year-old whips, the size recommended for planting, the author discusses the pruning and training of the apple tree at various stages of its development. Presenting data secured by W. A. Ruth and V. W. Kelley upon Oldenburg (Duchess) and Wealthy trees planted in 1920, it is shown that severe pruning delayed fruiting and decreased growth. In conclusion, it is advised to prune young trees lightly but that older trees require detailed pruning in order to secure larger and better colored fruits.

The correlation of trunk measurements with tree performance in apples, R. H. SUDDS and R. D. ANTHONY (*Amer. Soc. Hort. Sci. Proc.*, 25 (1928), pp. 244-246).—Suspecting that the failure of yield classes of 20-year-old Stayman and York trees grown under a wide range of treatments to follow a straight line when averaged and plotted against circumference might be due to a tendency for yields to vary with some power of the circumference, correlations were determined between yields and the simple, squared, and cubed circumferences. Very little difference was found between correlations obtained with the square or cube, but both were somewhat higher than that with the simple circumference.

Plotting theoretical volume, height by spread, with trunk circumference, correlations of 0.57 ± 0.08 and 0.54 ± 0.087 were secured for Stayman and York, respectively. No significant change in r values resulted from the use of squared or cubed circumferences.

In the case of Stayman trees grown in iron cylinders where correlations between weight and circumference of scaffold branches were computed, cubing of circumference tended to increase r somewhat over that secured with the simple circumference. In 12 of 14 groups of 3 trees each the value of r between branch circumference cubed and weight was better than 0.95 ± 0.013 . Between trunk circumference and weight of the entire top, r was 0.92 ± 0.017 for the 42 trees. Vigor materially influenced r between circumference of trunk cubed and length of annual growth, being much smaller in stunted trees. Total branch elongation since planting, correlated with trunk circumference cubed, gave an r value of 0.94 ± 0.01 . In Stayman trees budded on commercial and on clonal roots, correlations between diameter and weight at planting were 0.75 ± 0.027 and 0.77 ± 0.028 , respectively. No definite correlation was found between weight and height at planting and branch elongation 2 years later. Between squared trunk circumference increase for the 2 years and branch elongation in 1928 r was better than 0.75 ± 0.03 for both groups of rootstocks. The authors conclude that trunk circumferences or circumference increase records are highly valuable indexes to tree vigor.

The pollination problem in Massachusetts apple orchards, F. C. SEARS (*Mass. Fruit Growers' Assoc. Rpt.*, 3) (1928), pp. 233-239).—Believing that the unusually regular cropping of McIntosh trees in the Massachusetts Agricultural College orchard was due in part to location between Ben Davis and Wealthy varieties, certain pollination experiments were conducted. Averaged over a 3-year period, Baldwin, McIntosh, and Wealthy when self-pollinated gave 16.73, 2.99, and 6 per cent of set, respectively, as compared with maximums of 65.8, 35.9, and 58.3 per cent when cross-pollinated with McIntosh, Ben Davis, and McIntosh pollens, respectively.

Investigations on the handling of Bartlett Pears from Pacific coast districts, J. R. MAGNESS, H. C. DIEHL, and F. W. ALLEN (*U. S. Dept. Agr., Tech. Bul.* 179 (1929), pp. 25, pl. 1, figs. 11).—Studying the maturation changes in Bartlett pears by means of the pressure tester and color changes, striking differences were observed in the ripening and storage behavior of pears in relation to the environment under which grown. Pears from warm districts, particularly when grown with a minimum of water, were firm in flesh and of a distinctly yellow color when in a satisfactory picking condition. On the other hand, fruit from cooler sources was greener in color and softer of flesh at the corresponding stage. Pears in the cooler districts picked when registering 23 lbs. or more on the pressure tester did not ripen with even fair quality, while pears from hot, dry locations ripened even when testing above 23 lbs. Pears grown in cooler districts were found to become eating ripe sooner than those from hotter districts and not to last as well in good eating condition. There was observed no apparent relationship between growing environment and tendency to scald.

Pears ripened very little faster at 65° than at 53° F. At 43, 36, and 31° the storage life was about double that at 53, 43, and 36, respectively. Fruit held continuously at 31° ripened satisfactorily after 100 days of storage, but in general the longer pears were held in storage the poorer the ultimate quality. Fruit held for 30 days at 31° ripened with almost equal quality to that of unstored fruit, but after 60 days quality diminished, and after 90 days fruit was generally fair in quality only. The best ripening temperature following removal from storage was from 60 to 70°. To avoid scald, pears should be removed from storage before becoming full yellow. For transcontinental shipment 43° is considered more desirable than 53°, since pears held 12 days at the former temperature were still hard green.

Some effects of different heights of pruning on the yield of the Latham raspberry, W. G. BRIERLEY (*Minn. Hort.*, 57 (1929), No. 4, pp. 107-112, figs. 2).—As a part of an intensive study in progress at the Minnesota Experiment Station to determine the effects of different heights of pruning upon the growth and fruiting of the red raspberry, records are presented in this paper upon the yields and size of fruits, as measured by weight, of Latham raspberry plants pruned at 15-, 36-, and 60-in. heights. The plantation was established in 1925 and data recorded in 1928. In respect to total yields, there was but little difference between the 36- and 60-in. plants, but the average weight of the individual berries was significantly lower in the 60-in. lot than in either the 36- or 15-in. groups. The 60-in. plants were the first to ripen fruits, due apparently to early ripening on the short, weak laterals toward the tips. Severe pruning, as in the case of 15-in. plants, was decidedly harmful, cutting total yields to less than 50 per cent of the other two treatments. The computed yields per acre were 3,059, 6,490.1, and 6,602.5 pints for the 15-, 36-, and 60-in. plants, respectively. All three lots showed a progressive decline in size of berries as the season advanced.

The coconut palm, F. W. T. HUNGER (*Kokospalme. Hamburg: Deutscher Auslandsverlag, 1929, pp. VII+130, figs. 30*).—Information is given on culture, botany, and utilization.

A preliminary study of the pollination of the Alphonso mango, P. V. WAGLE (*Agr. Jour. India, 24 (1929), No. 4, pp. 259-263*).—Continuing his studies upon reproduction in the mango (E. S. R., 60, p. 46), the author reports that in the Alphonso variety dehiscence of the anthers generally occurs between 8 and 11 a. m. Approximately half of the perfect flowers remained unpollinated, despite the presence of adequate pollinating agencies, insects, and air movement. Stigmas were observed to remain receptive for three days but were most successfully pollinated the first day. The Alphonso mango was successfully fertilized with pollen taken from native mango trees.

Mango culture in Hawaii, W. T. POPE (*Hawaii Sta. Bul. 58 (1929), pp. 27, pls. 18*).—The history of the introduction of the mango into Hawaii, methods of propagation, cultural requirements, control of pests, and description and classification of varieties are among the subjects discussed in this general bulletin.

Temperature experiments in germinating orange seeds, H. S. FAWCETT (*Calif. Citrogr., 14 (1929), No. 12, p. 515*).—Taking seeds directly from fruits and planting them in jars of sand kept uniformly moist and held at various maintained temperatures with light supplied artificially after germination, the author found that the optimum range for sweet orange germination and early growth was from 75 to 85° F. and for sour orange from 75 to 80°. At 55° no sweet orange seeds germinated in 105 days, but sour oranges showed some germination in 90 days. No seed of either species germinated at a constant temperature of 104°.

Cacti, D. GRIFFITHS and C. H. THOMPSON (*U. S. Dept. Agr. Circ. 66 (1929), pp. 26, pls. 19, figs. 2*).—A revised and enlarged edition of a previously noted bulletin (E. S. R., 28, p. 342) dealing principally with species and varieties, propagation, indoor and outdoor culture, and uses as ornamentals and food.

Hardy roses for South Dakota, N. E. HANSEN (*South Dakota Sta. Bul. 240 (1929), pp. 48, figs. 8*).—Consisting primarily of notes on various species and varieties of roses, particularly those bred at the station, this bulletin also contains information on the origin of the cultivated rose, stocks for propagation, pruning, winter protection, utilization, etc.

FORESTRY

Forest possibilities of aspen lands in the Lake States, J. KITTEDGE, JR., and S. R. GEVORKIANTZ (*Minnesota Sta. Tech. Bul. 60 (1929), pp. 84, figs. 10*).—Approximately 21,000,000 acres of aspen-birch lands occur in the cut-over area of northern Minnesota, Wisconsin, and Michigan, a region formerly occupied chiefly by valuable conifers and hardwoods. Aspen, because of its root suckering habit, has successfully withstood the repeated fires which have swept the region following lumbering and which have destroyed the more valuable species. Aspen is not exacting in respect to soil, as evidenced by its widespread distribution. Surveys of the aspen region indicated that about 20 per cent of the lands are being naturally converted to coniferous forests. Presuming that another 20 per cent may be converted by private enterprise and that 30 per cent will be used profitably, there is a balance of 30 per cent destined to become an economic loss unless taken over for replanting by public agencies or unless further uses for aspen lumber are developed.

Considerable data are presented on the distribution of the aspen lands, growth of aspen on various quality sites, yields of well-stocked stands at

various ages, the average composition of stands as respects diameter, the manner of reproduction and natural conversion to better species, effect of rodents and other animal life on the establishment of conifer trees, growth of conifers in aspen stands, silvicultural practices in hastening the conversion of aspen, etc.

Appended are volume tables for aspen and paper birch and a list of the common and scientific names of trees and plants found in the region.

Studies in tolerance of New England forest trees.—IX, **Rainfall and width of annual rings in Vermont forests**, G. P. BURNS (*Vermont Sta. Bul.* 298 (1929), pp. 24, figs. 17).—A further contribution to a general series (E. S. R., 60, p. 144).

Pointing out that many factors, such as run-off, seepage, surface evaporation, water used by ground cover plants, the amount of rainfall at a given time, and the density of the stand, are involved in the amount of soil water available to a tree, the author presents diameter increment data from thinned and unthinned plots located at various points in the State, all of which tend to show that under comparable conditions trees of the same original diameter failed to make similar gains in growth. It is assumed that trees of a forest species, like those of a cultivated form, undoubtedly vary in their response to environment.

As an example, in an analysis of records taken on 18 dominant white pines in the 10-in. class growing under identical conditions of rainfall the increases over an 11-year period when expressed in the percentage of the slowest growing trees were 100, 263, 263, 410, 515, 558, 600, 600, 600, 684, 684, 726, 768, 768, 768, 810, 853, and 1,021. Similar variations were observed in the trees of the several experiments and were not confined to any one species. Attempts to calculate rainfall from diameter growth by dividing the total rainfall of the 11 years by the average increase of all trees in each diameter class were wholly unsuccessful. Some indication was obtained of a correlation between diameter gain and the amount of space available to the tree, especially in stands where root competition was not present.

Contributions to the problem of the relation between forest and water in Japan, T. HRATA (*Tokyo: Imp. Forestry Expt. Sta., 1929, pp. 41, fig. 1*).—Data are presented upon the amount of precipitation intercepted by the foliage of trees, upon comparisons of run-off before and after deforestation of given areas, upon seasonal variation in soil water in the forest, etc.

Cover type and fire control in the national forests of northern California, S. B. SNOW and E. I. KOTOK (*U. S. Dept. Agr. Bul.* 1495 (1929), pp. 36, pls. 4, figs. 11).—Recognizing cover types as an important consideration in fire control, data are presented for nine major types in the forests of northern California in reference to the length of the fire season, prevalence of fires, rapidity of spread, and difficulty of control. Data presented on the seasonal and annual rainfall and duration of the rainless period for each type show marked variation. For example, the fire season, May to October, inclusive, showed only 2.65 in. of rain in the grassland cover and a maximum of 8.26 in. in the fir regions.

The density of the stand was greatest in the upland fir type and least in the valleys and greatly influenced the type of cover and incidentally the fire hazard, since grass, weeds, and undergrowth in the rather open forests supplied abundant fuel, while in the denser stands undergrowth was suppressed and fires more often confined to the duff, where they spread relatively slowly.

Analyzing reports from a total of 10,476 fires, from 1911 to 1920, it was found that the longest fire season, 5½ months, occurred in the chaparral and brush cover types and the shortest, 4 months, in the fir and sugar pine-fir types. The largest number of fires occurred in the western yellow pine and

mixed fir types, which also accounted for the most lightning-caused fires. Man-caused fires were most abundant in the chaparral. As a rule, lightning-caused fires were most easily controlled because of accompanying rains.

Protection was least successful in the chaparral and brush types because of the vast amount of highly inflammable material. Speed of attack was one of the dominant factors in the control of fires. The greatest cost of suppression per given area was in the chaparral cover type, followed by the brush and woodland. In the timber types suppression costs were lowest in the pure fir and highest in the Douglas fir.

In concluding, the authors point out that only in the pure fir type have fires been kept below the accepted maximum of 0.2 per cent of the area per year. Therefore, the need of greater development of protection activities is deemed highly desirable in all the other types. It is suggested that future research should aim to associate cover types not only with silvicultural practice and range uses but also with forest protection requirements.

Shelter belts for central Montana (*Montana Sta. Rpt. 1928, pp. 48, 49*).—Of various species tested, Caragana, or Siberian pea-tree, has proved the most valuable kind for general purposes. The trees of this species grew well, were drought resistant, and effective as shelter belt material. Boxelder and green ash also proved suitable but were slower in growth. Cultivation was found desirable, even after the plantation was started. Moderate pruning to shape the trees was beneficial, but severe pruning was deleterious.

DISEASES OF PLANTS

[**Plant disease investigations in Kentucky**] (*Kentucky Sta. Rpt. 1928, pt. 1, pp. 13-16, 30, 31*).—In continuation of previous reports on tobacco mosaic (E. S. R., 60, p. 239), it is stated that tobacco mosaic infection may be spread at pulling time by the hands of men who smoke air-cured or fire-cured tobacco as well as by those of men who only chew. By selection and roguing, the mosaic appearing in the second suckers was reduced to 0.7 per cent. Of commercial smoking tobacco in tins, each of 15 brands carried mosaic, but in these cases it was more difficultly transmitted by handling. Of 15 brands of cigars, about half carried mosaic in a form readily transmissible to the tobacco plants. A study of 11 brands of plug chewing tobacco sliced, mixed with water, and rubbed on tobacco plants between pulling and setting gave, respectively, 7, 2, 1, 1, and 6 mosaic plants from 5 of the respective brands, in sets of 50, the remainder showing no mosaic. From natural leaf decoction, 41 of 64 plants developed mosaic.

Of cucumber mosaic, those strains previously reported as puff, mild puff, and severe puff were studied, and each produced mosaic, but of intensity differing in cucumbers from that in tobacco. The original severe puff proved to be mixed with "healthy potato" virus, and each was obtained in pure culture.

"Tomato streak" was produced by a mixture of the "healthy potato" virus with puff, severe puff, etch+, severe etch, and the various strains of true tobacco mosaic. It was produced also by a strain of tobacco mosaic, "C. T.," when this was used alone. This is supposedly not a mixture of "healthy potato" virus and tobacco mosaic. "Evidence is accumulating which indicates that tomato mosaic of the type severe enough to be readily recognized is commonly caused by one of the etch group of viruses and not by true tobacco mosaic, although the latter group will cause tomato mosaic."

Eradication of near-by solanaceous weeds lowered incidence of ~~virus~~ diseases other than true tobacco mosaic. These weeds are thought in part to have car-

ried virus infection from diseased potatoes, and now to constitute a menace to both tobacco and potatoes. Cobbler potatoes were not free from "healthy potato" virus by sprouting in darkness, as the virus was present in the etiolated tips of sprouts 16 in. long.

Tobacco angular leaf spot and wildfire may prove to be overwintered and transmitted by neighboring wild plants. It was proved that much of the western Kentucky black fire was due to abnormal nutrition rather than to bacteria, and that it is controllable by the liberal use of stable manure. *Bacterium angulatum* and *B. tabacum* are much more injurious to nitrogen-starved plants than to those well supplied with nitrogen.

A preliminary trial of hybrid strains of Burley highly resistant to black root rot in comparison with the previously introduced resistant selections shows the former to be rapid growers, and in some cases excellent in quality even on infected land. Tests suggest that resistant plants may be grown with little danger of injury in an infected seed bed. Steamed beds kept in regular use proved to be heavily infected with the black root rot organism.

Tobacco brown rot was particularly severe after a corn crop. Isolations throughout the summer yielded an organism resembling *Pythium*. Corn roots collected during the winter from this field caused a disease of tobacco similar to brown root rot when dead corn roots from a "continuous corn" plot were mixed with sand in which the tobacco was subsequently grown, and the rotting tobacco rootlets were found to contain *Pythium* spores of the same type as those found in rotting corn roots. It is thought that the *Pythium* causing corn rot in Kentucky causes also tobacco brown root rot.

In tests for the control of pear and apple blight during 3 years in a Johnson County orchard where the disease had caused almost total loss during 5 years, practically complete control was attained in the case of Yellow Transparent parent apples and in an adjacent block of pears by cutting out the few cankers in the pear trees. A satisfactory set has not been obtained in the other pear block, and pear blossom blight caused some damage each year. A lack of vigor is held to account for the poor set and for longer retention of the bloom, resulting in greater opportunity for the spread of the blight.

[Plant diseases, Montana] (*Montana Sta. Rpt. 1928, pp. 13, 14, 30, 31, 47, 48*).—On account of the heavy losses from wheat smut during recent years, the agronomy department is attempting to determine the relative smut resistance of existing varieties otherwise desirable, and by breeding to develop more resistant lines. Montana No. 49 and C. I. No. 8033 are both markedly resistant to *Tilletia levis*, and the latter wheat is also winter hardy and more productive than Montana No. 36 or Karmont, both standard for Montana conditions. All other possibilities as parental forms. The program for 1929 was expanded to include also oats and barley.

As a consequence of a plant disease survey covering most of the State, and a compilation of earlier records, the total of known plant diseases in Montana is now about 1,200 existing on native plants, cultivated crop plants, trees, and ornamentals.

Of potato diseases, the viruses are the most destructive, and aphids are the main aids in their distribution. Work is proceeding on the efficiency of roguing and the recording of symptomatology of the several virus diseases.

Barberry eradication is gradually being carried forward.

Wheat foot rot experience of earlier years as continued by that of 1928, in connection with a check of tillage methods, varieties, etc., indicated that the date of seeding is the most important factor. Plantings made in September returned maximum yields for the season, which for that year extended from July 15 to November 4, 1927.

Further agglutination tests with bacterial plant pathogenes, I, II (*Bot. Gaz.*, 85 (1928), No. 2, pp. 178-197, 198-207).—Two papers are here given.

I. *Bacterium campestre*-*Bact. phaseoli* group; *Bact. medicaginis* var. *phaseolicola*; *Bact. tumefaciens*, G. K. K. and A. DeS. Link.—In recent papers, Sharp, and Link and Sharp (*E. S. R.*, 60, p. 545) have reported success in differentiating plant pathogenes by the agglutination test. Some of this work is briefly described.

The first part of the experimentation here reported is said to be a continuation of the study of the yellow organisms of the so-called *B. campestre*-*B. phaseoli* group of Smith (*E. S. R.*, 48, p. 142). The second part of the experiments here reported grew out of Sharp's study referred to above.

It is claimed that the agglutination test can be used to differentiate *B. malvacearum* from the yellow organisms *B. campestre*, *B. phaseoli*, *B. citri*, *B. cucurbitae*, and *B. pruni*. Serologically *B. malvacearum* is more closely related to *B. phaseoli* and *B. phaseoli sojense* than to *B. campestre*. The yellow organisms tested are supposedly not a single group serologically. *B. campestre*, *B. malvacearum*, *B. phaseoli*, *B. phaseoli sojense*, and *B. flaccumfaciens* supposedly constitute a serological group. *B. medicaginis phaseolicola* can be differentiated by the agglutination test from the bean pathogenes *B. phaseoli*, *B. phaseoli sojense*, and *B. flaccumfaciens*.

When the antiserum of *B. tumefaciens* is tested against suspensions of the homologous and of various heterologous organisms, highly specific agglutination occurs. When the antisera of these heterologous organisms are tested against suspensions of *B. tumefaciens*, agglutination usually takes place in the lower dilutions.

II. *Soft-rot* group: *Bacillus aroideae* and *B. carotovorus*, G. K. K. Link and W. H. Taliaferro.—It is claimed that the agglutination test can be used to differentiate *B. aroideae* and *B. carotovorus* of the soft rot group from *Bacterium campestre* of the *B. campestre*-*B. phaseoli* group, from *B. medicaginis phaseolicola*, and from *B. tumefaciens*. Serologically, it is claimed, *Bacillus aroideae* and *B. carotovorus* are distinct although closely related. Maintenance of *B. aroideae* and *B. carotovorus* as distinct species is considered to be justified serologically.

Mottling and mosaic disease [trans. title], E. SCHAFFNIT (*Forsch. Geb. Pflanzenkrank. u. Immunität Pflanzenr.* No. 4 (1927), pp. 16-22, figs. 6).—Chiefly this is an attempt at exact description and definite naming of coloration considered abnormal in plants and presumably caused by so-called viruses.

Further notes on *Rhizoctonia bataticola* (Taub.) Butler, W. SMALL (*Trop. Agr. [Ceylon]*, 71 (1928), No. 2, pp. 77-80).—In these notes, following up those previously noted (*E. S. R.*, 59, p. 636), new hosts of *R. bataticola* are recorded. It is stated that Steinmann of the Tea Experiment Station, Buitenzorg, has reported finding *R. bataticola* on tea and *Albizia* roots sent from Sumatra.

Clear examples of the *Rhizoctonia* root disease appeared in the case of citrus seedlings dying in a nursery of the Royal Botanic Gardens, Peradeniya. Two examples of fatal *Rhizoctonia* root disease of young *Cupressus lindleyi* occurred in the grounds of the Farm School, Peradeniya. Of a small consignment of sweetpotato (*Ipomoea batatas*) tubers obtained from the experiment station at Peradeniya, about 20 per cent showed the distinctive character (*Rhizoctonia sclerotia*) of Taubenhaus's charcoal rot. In roots of *Areca catechu*, *Rhizoctonia sclerotia* were found. *Rhizoctonia* and *Fomes* were found on the roots of *Crotalaria*, and *Rhizoctonia*, *Diplodia*, and *Fomes* on a young rubber tree, Cases of *Rhizoctonia* root disease of cacao have been seen. *Helianthus annuus*

in a wilted state showed numerous sclerotia in the stem bark and cortex at ground level.

The parasitism of *Rhizoctonia bataticola* (Taub.) Butler and other fungi, W. SMALL (*Trop. Agr. [Ceylon]*, 71 (1928), No. 4, pp. 215-227).—Arguments are summarized for or against the parasitism of *Rhizoctonia* and the mycorrhizal condition of the fungus is discussed, which remarks concerning the systematic position of the fungi which have been regarded as the causes of root disease. The author holds that the supposed disturbing conditions (physiological or fungus) are neither apparent nor essential for *Rhizoctonia* attack in the field and in experimentation, that they have not been shown in operation and are only supposed to be present, that, in general, the other fungi which are said to attack before *Rhizoctonia* have not been proved capable of attacking, and that *Rhizoctonia* is found in such positions (for example, living roots).

Scab of wheat and barley and its control, J. G. DICKSON and E. B. MAINS (*U. S. Dept. Agr., Farmers' Bul.* 1599 (1929), pp. 11+18, figs. 16).—This publication summarizes Farmers' Bulletin 1224 (*E. S. R.*, 46, p. 240), but deals also with barley. The disease attacks both heads and seedlings of small grains, and in corn it attacks seedlings, stalks, and ears, overwintering in cornstalks and also in small grains, straw, and stubble. Losses depend chiefly on a relatively abundant infection on residues and on weather conditions during or soon after the blossoming of the grain. The disease appears during humid summers on poorly prepared cornland or wheatland. Practically applicable methods include clean plowing, thorough clean-up of crop refuse, rotation, and the use of adapted varieties and of high grade and thoroughly treated seed.

Susceptibility of wheat varieties and hybrids to fusarial head blight in Minnesota, J. J. CHRISTENSEN, E. C. STAKMAN, and F. R. IMMER (*Minnesota Sta. Tech. Bul.* 59 (1929), pp. 24, figs. 2).—During the previous nine years more than 350 spring varieties, selections, and hybrids of *Triticum* spp. have been tested for relative susceptibility to *Fusarium* head blight and seed blight at University Farm, and 50 of these at Waseca, Minn., all becoming infected in some degree. The common wheats were usually more resistant than the durum, though some were very susceptible. The durum showed considerable variation as regards scab resistance.

In a study regarding the behavior of crosses between susceptible and resistant parents both at University Farm and at Waseca, most of the hybrids from Marquis×Preston and from Marquis×Haynes Bluestem reacted immediately to scab, some equaling the resistant parent. All the Kota×Marquis hybrids were susceptible.

No apparent gross morphological character in any wheat showed high correlation with resistance or susceptibility. No statistically significant differences were demonstrated between correlation coefficients from heads infected and seeds blighted in the same varieties and lines grown in different years, or in two different series in the same year. Correlations ranged between $+0.86 \pm 0.01$ and $+0.92 \pm 0.01$. Evidently, a number of variables influenced significantly the infection percentage, such variables including differences in meteorological conditions and in the prevalence of different species and physiological forms of the pathogenes.

Caution is urged as to conclusions from tests unless long and adequately conducted

Some diseases of unknown nature observed on green manure crops [trans. title], M. B. SCHWARZ (*Landbouw [Buitenzorg]*, 3 (1927), No. 4, pp. 201-219, figs. 11; *Eng. abs.*, pp. 214, 216, 219).—This paper deals with green

manure crop diseases of unknown nature but of either economic importance or striking appearance, including witches'-broom or curly disease of *Crotalaria anagyroides* and of *C. juncea*, curvy disease of *C. anagyroides*, and curly disease of *Calopogonium mucunoides*, with accounts of related occurrences.

The isolation of protocatechuic acid from pigmented onion scales and its significance in relation to disease resistance in onions, K. P. LINK, H. R. ANGELL, and J. C. WALKER (*Jour. Biol. Chem.*, 81 (1929), No. 2, pp. 369-375).—In reports previously noted (E. S. R., 52, p. 846; 53, p. 348), it was shown that the red and yellow varieties of the common bulb onion (*Allium cepa*) are in general resistant to the onion smudge fungus (*Colletotrichum circinans*), whereas the white varieties are susceptible; also, that an aqueous extract of the dry outer pigmented scales causes rupturing of abnormal germination of the spores and retards mycelial growth of *C. circinans*, whereas a similar extract from the dry outer white scales does not retard this growth. It was thought likely that the chief factor conferring the power of resistance upon the pigmented onion scales was some substance or group closely associated or identical with the red and yellow pigments present. The present account reports the isolation and identification of one toxic entity obtained from the pigmented scales but not from the white. This toxic entity has been isolated from pigmented onion scales, and has been definitely characterized and identified as the phenolic acid commonly known as protocatechuic acid (3, 4-dihydroxybenzoic acid). It appears to be one of a group of toxic substances present in the pigmented onions and conferring upon them resistance to the inroads of the onion smudge fungus (*C. circinans*).

Rosette disease investigations, [A. J. BROOKS] (*Gambia Dept. Agr. Ann. Rpt. 1927-28*, pp. 11-16).—Virus disease is said to be the most serious problem at present affecting the locally important peanut-growing industry. The effect on the crop, as here indicated, is to increase the empty shells by 34 to 55 per cent and to decrease the good nuts by 43 to 64 per cent and the total nuts by 18 to 24 per cent. In one badly infected area the crop yield was reduced from 584 to 188 bu.

Among the insects collected in the search for carriers are two new jassids (*Cicadulina* spp.). Of the two species previously known of this genus, it is stated, one has been shown to carry the streak disease of maize. The insect vector of rosette disease in South Africa is known to be *Aphis leguminosae*, but this aphid has not been found in a protracted search in Gambia. The carrier appears to be most active in late July and early August. No food plants other than peanuts have been found. Infection apparently is not carried in the seed. The most susceptible period occurs a few weeks after germination. Rainfall apparently renders the carrier less active. Early planting is advantageous. Discussion is given of the incidence of the disease, its general crop effect, and control methods, which as yet include only the destruction of germinating seed left after cropping, early sowing, and roguing throughout the growing period.

As to resistant lines, Dasse has been thought to be as yet the most promising, though field trials place Philippine Pink and Philippine White in the same general class, showing definite resistance to the virus disease.

Potato early blight [trans. title], M. BENILOCH (*Bol. Patol. Veg. y Ent. Agr. [Madrid]*, 2 (1927), No. 8-9, pp. 107-113, figs. 3).—An account is given of the appearance at points in Spain of potato early blight (*Alternaria solani*) and of the relations, progress, and effects of the disease. Among plants harboring the fungus are named *Datura stramonium*, *Hyoscyamus albus*, *H. niger*, and *Solanum nigrum*.

Preventive measures include destruction of plant residues, application of Bordeaux mixture to infected areas, and, in case of intensive infection, the cultivation on such areas during 3 or 4 years of immune plants.

Cherry leaf shot hole and apple and pear scab [trans. title], H. FAES and M. STAEBELIN (*Ann. Agr. Suisse*, 29 (1928), No. 1, pp. 83-92, fig. 1).—This account presents data, obtained since the account of the previous year (E. S. R., 61, p. 348), on cherry leaf shot hole (*Clasterosporium carpophilum*), with a somewhat detailed account of the scab organism of apple (*Fusicladium dendriticum*) and that of pear (*F. pirinum*).

Some problems of the Lanarkshire strawberry industry, C. W. WARDLAW (*Scot. Jour. Agr.*, 10 (1927), No. 2, pp. 156-165, pl. 1).—This is a discussion of more general character than related accounts which have been noted (E. S. R., 58, p. 249; 59, p. 545). Recognition is given regarding the seriousness of the situation brought about within six years or so by the Lanarkshire strawberry disease, which, it is said, may occur on a wide range of soils (sandy silts to clays), and which, though most common on land long cultivated in strawberries, has also been found lately on land recently broken out of fallow.

Lanarkshire strawberry disease, C. W. WARDLAW (*Scot. Jour. Agr.*, 11 (1928), No. 1, pp. 65-71, pl. 1).—Continuing observations noted above, the bearings are indicated of weather conditions during (especially) winter and spring, the seasonal growth of the plant, the site with respect to drainage, the soil reaction, and soil cultivation by such methods as will improve the texture and increase the availability of its nutrients.

Powdery mildew of the grape and its control in California, H. E. JACOB (*Calif. Agr. Col. Ext. Circ.* 31 (1929), pp. 18, figs. 7).—Powdery mildew (*Uncinula necator*), the most serious fungus of the vine in California, present in nearly every vineyard section in the State, and capable of causing great loss each year to all vines not adequately protected, is dealt with as to the points and mode of attack, the life history, conditions, and control measures.

Sulfur, when relied upon, must in the interior valleys keep the growing portions well covered, and for this purpose it should be applied when the shoots are from 6 to 8, 15 to 18, and 24 to 36 in. in length. For late-maturing varieties a fourth application when the berries are well set is advisable, and in the coast regions a fifth application should be added when the berries are well grown. Procedure and cautions are indicated to fit conditions prevailing locally. Winter spraying is ineffective.

The stem-bleeding disease of arecanut (*Areca catechu*) caused by *Thielaviopsis paradoxa* von Hon., S. SUNDARARAMAN, C. K. NATAR, and T. S. RAMAKRISHNAN (*Agr. Research Inst., Pusa, Bul.* 169 (1928), pp. 12, pls. 5).—A disease of areca nut first appearing in Malabar in 1925 and showing symptoms like those of the bleeding disease of coconut has been named the bleeding disease of areca nut. A *Thielaviopsis* isolated from the diseased palm was cultured and studied comparatively and was found to be identical with *T. paradoxa* from sugarcane. The methods used against the coconut disease were effective also in the case of areca nut.

Bunchy-top disease of plantains in Ceylon, W. SMALL (*Trop. Agr. [Ceylon]*, 71 (1928), No. 3, pp. 141-147, pl. 1).—The author, treating *Musa paradisiaca* and *M. sapientum* as identical, states that plantain bunchy top is prevalent and destructive, allegedly constituting a limiting factor for banana cultivation, in parts of Ceylon. Some discussion is given of the report made by Magee (E. S. R., 60, p. 451), with reasons for thinking that the Australian findings are not to be accepted in full for Ceylon without further investigation of the root factors which accompany the insect factor in the causation of banana bunchy top.

An account is given of a preliminary experiment carried out at Peradeniya. Though the object, the infection of plantain roots with *Rhizoctonia bataticola*, was apparently attained, other factors of interest entered into the experiment, which is herein briefly described. Two plants were exposed to soil infection by *Rhizoctonia*, and two were grown as controls. Both nematode and aphid factors appeared, affecting both sets of plants. Only the plants exposed to the soil fungus and infected by it developed bunched top, but the author does not conclude that *Rhizoctonia* is the sole cause.

A note on cover crops in relation to root disease of rubber, R. K. S. MURRAY (*Trop. Agr. [Ceylon]*, 71 (1928), No. 4, pp. 233-236).—The influences of erect and of creeping cover crops are discussed, with the recommendation that cover crops, in particular, *Vigna*, be omitted or removed in areas known to be affected with root disease.

Ustilina zonata (Lev.) Sacc., a warning note, F. W. SOUTH (*Trop. Agr. [Ceylon]*, 71 (1928), No. 2, p. 97).—Attention is directed to the prevalence of the dry-rot fungus, *U. zonata*, on the stems and main branches of rubber trees on some of the older rubber estates, especially in the coastal districts of Selangor.

Decay of slash of northern white pine in southern New England, P. SPAULDING (*U. S. Dept. Agr., Tech. Bul.* 132 (1929), pp. 20, figs. 3).—As a result of preliminary investigations on the decay of slash (logging debris) from northern white pine (*Pinus strobus*) in southern New England, the usual course of its rotting is outlined. In the second year fruiting bodies of wood-rotting fungi begin to form, *Lenzites sepiaria* and *Polystictus abietinus* usually being the first to appear. During the fourth year decay becomes well advanced. In the seventh to the ninth years the piles flatten down. By the fifteenth year most of the slash is well rotted, though practically sound pieces may persist. By the twentieth year the material constitutes a mat of fibrous mold under the recently fallen leaves. Very wet or dry conditions may prolong this process some 10 years.

Of the 23 different species of fungi participating, *L. sepiaria* is most efficient quantitatively, and *P. abietinus* ranks next, the rest being chiefly saprophytic. *L. sepiaria*, after the sapwood is rotted, finishes up the heartwood.

As regards the other factors, the type of the slash is important. Forestry sites and soils appear unimportant. Retardation is apparent on western and northern slopes and acceleration on southern and eastern slopes. The sun's heat may be decisive. Soil moisture is important. Swampy, water-logged conditions indefinitely postpone decay.

With the possible exception of *Stereum sanguinolentum*, none of these rot fungi appear to threaten the on-coming new forest growth.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Manual of the vertebrate animals of the northeastern United States, D. S. JORDAN (*Yonkers-on-Hudson, N. Y.: World Book Co., 1929, 13 ed., rev. and enl., pp. XXXI+446, figs. 16*).—This is a completely revised and enlarged edition of a work first published in 1876, a revision of which appeared as the fifth edition in 1888, the succeeding editions having differed only in such alterations as could be made in the plates. The work includes an analysis of the classes of Chordata and tables for the separation of the orders, families, and genera. For each of the 1,373 species listed the author gives the scientific name, common name, detailed description, habitat, distribution, synonyms, and meaning of scientific name. The district covered is, approximately, the northeastern United States and southern Canada, extending from Labrador westward to and including Manitoba and North Dakota, and southward to and including North

Carolina and Kansas. The resident shore fishes of the region are included, but for the most part not the strays from the Gulf Stream or the fishes of the deep seas. The birds which are chance wanderers from Europe or the West Indies are also omitted or, at the most, merely mentioned. A glossary of terms is appended. The introduction is by B. W. Evermann.

Game laws for the season 1929-30: A summary of Federal, State, and Provincial statutes, F. L. EARNSEAW and F. G. GRIMES (*U. S. Dept. Agr., Farmers' Bul. 1616 (1929), pp. II+46*).—This is the thirtieth annual summary (*E. S. R.*, 60, p. 158).

The red squirrel: Its life history and habits, with special reference to the Adirondacks of New York and the Harvard Forest, R. T. HATT (*Roosevelt Wild Life Ann. [Syracuse Univ.], 2 (1928), No. 1, pp. 146, pl. 1, figs. 52*).—A report of biological studies of the red squirrel *Sciurus hudsonicus*. An annotated list of forest trees, shrubs, and other sources of squirrel food (pp. 86-121) and a list of references to the literature (pp. 140-146) are included.

The Corvidae of Europe, P. MADON (*Les Corvidés d'Europe. Paris: Paul Lechevalier, 1928, pp. 257+27*).—This is an account of studies of the crow and jay family, their diet, digestion, insect food, etc., particularly as related to agriculture.

The cuckoo, E. A. ARMSTRONG (*Sci. Prog. [London], 24 (1929), No. 93, pp. 81-96, pl. 1*).—A summary of information on the life history and habits of this bird.

The life history of the toucan, Ramphastos brevicarinatus, J. VAN TYNE (*Mich. Univ., Mus. Zool., Misc. Pub. 19 (1929), pp. 43, pls. 8, fig. 1*).—A report of studies of the life cycle, habits, and distribution of this bird in the Canal Zone.

Some causes of bird mortality, F. C. LINCOLN (*Jour. Wash. Acad. Sci., 19 (1929), No. 14, pp. 316, 317*).—This is an abstract of an address that is based upon mortality records obtained in bird-banding work by the U. S. D. A. Bureau of Biological Survey.

Handbook on the investigation of animal parasites of man and domestic animals, E. REICHENOW and G. WÜLKER (*Leitfaden zur Untersuchung der Tierischen Parasiten des Menschen und der Haustiere. Leipzig: Curt Kabitssch, 1929, pp. VII+235, figs. 104*).—Part 1 of this work, which is a new edition of the handbook by Braun and Lühe (*E. S. R.*, 23, pp. 163, 555), deals with the protozoa (pp. 1-105), part 2 with the Vermes (pp. 106-200), and part 3 with the Arthropoda (pp. 201-225).

A study of the moisture requirements of the eggs of the horse, the dog, human, and pig ascarids, G. F. OTTO (*Amer. Jour. Hyg., 10 (1929), No. 2, pp. 497-520, figs. 2*).—In laboratory experiments eggs of the horse ascarid, *Parascaris equorum*, were more resistant to desiccation than those of the dog ascarid, *Toxascaris canis*, and human and pig ascarids, *Ascaris lumbricoides* and *A. suum*, respectively. A list is given of 25 references to the literature.

Leptospira icterohaemorrhagiae in Oxford rats, A. D. MIDDLETON (*Jour. Hyg. [London], 29 (1929), No. 2, pp. 219-226, figs. 3*).—The author found 41.7 per cent of the rats in the Oxford district in England to carry *L. icterohaemorrhagiae* in their kidneys. The percentage of infection has been found to increase until the animals are mature, reaching a maximum of 56 per cent among one class of the population, but it is less among the oldest rats. Evidence was obtained that the organism is acquired comparatively early in life, and that immunity is obtained after a long period of infection.

[Contributions on economic zoology and entomology] (In *X. Congrès International de Zoologie, Budapest, 1927. Budapest: Impr. Stephaneum, 1929.*

pts. 1, pp. 206-225, 248-260, 272-300, pl. 1, figs. 26, pp. 324-326, 345-357, figs. 6, pp. 455-462; 2, pp. 1043-1052, 1076-1096, 1097-1117, figs. 5, pp. 1181, 1182, 1183-1195, figs. 4, pp. 1209-1218, fig. 1, pp. 1219-1233, 1234-1244, figs. 5, pp. 1245-1248).—Among the papers presented at the International Zoological Congress held at Budapest in September, 1927, relating to economic zoology and entomology are the following: The Geographic Parthenogenesis [trans. title], by A. Vandel (pp. 206-222); Control of the Nun Moth through Application of Calcium Arsenate by Airplane [trans. title], by J. Komárek (pp. 223-225); The Physiology of the Senses of Bees [trans. title], by K. von Frisch (pp. 248-260); Reindeer Husbandry and Reindeer Parasites in Norway [trans. title], by L. R. Natvig (pp. 272-300); A Cinematographic Film Representing the Life History of the Human Blood Flukes *Schistosoma* (Bilharzia), by M. Khalil (pp. 324-326); The Propagation and Ecological Significance of the Hemoglobins in Chironomid Larvae [trans. title], by O. Harnisch (pp. 345-357); Artificial Fertilization of the Honeybee [trans. title], by H. Prell (pp. 455-462); The Need for the Entomological Bibliography [trans. title], by W. Horn (pp. 1043-1052); The Morphology and Biology of the Coccid *Margarodes polonicus* [trans. title], by A. W. Jakubski (pp. 1076-1096); The Biology of Termites in Java [trans. title], by N. A. Kemner (pp. 1097-1117); The International Aspects of Entomology, by L. O. Howard (pp. 1181, 1182); The Natural Control of *Pyrausta nubilalis* Hb. in Europe, by W. R. Thompson (pp. 1183-1195); Biotic Potential, Environmental Resistance, and Insect Abundance, by R. N. Chapman (pp. 1209-1218); The Grape Leaf Roller Problem in Hungary in the Light of Thirty Years of Observation and Control Work [trans. title], by G. Bakó (pp. 1219-1230); *Pyrameis cardui* L. as an Agricultural Pest in Hungary [trans. title], by G. Kadocsá (pp. 1231-1233); The German Apicultural Research Institute: Its Aims and Problems [trans. title], by J. Evenius (pp. 1234-1244); and Applied Zoology and Fur Farming [trans. title], by W. Stichel (pp. 1245-1248).

[Notes on economic insects and insect control] (*Jour. Econ. Ent.*, 22 (1929), No. 3, pp. 594, 595-603).—The brief accounts here presented include Notes on the Ovicidal Action of Linseed Oil, by J. W. Lipp (p. 594); The Striped Peachworm (*Gelechia confusella* Chambers) on Cottonaster, by P. J. Chapman of the Virginia Truck Experiment Station (p. 595); An Outbreak of the Fig Moth [*Ephestia cautella* Walk.] in California, by P. Simmons and W. D. Reed (pp. 595, 596); Insecticides Patent, by R. C. Roarek (p. 596); Injury to Sweet Potatoes in Storage by the Semitropical Armyworm, by W. A. Thomas (pp. 596, 597); Notes on *Leptoglossus phyllopus* L. and *L. oppositus* Say, by T. L. Bissell (pp. 597, 598); *Ateloglossa cinerea* Coq., a Parasite of *Melanotus* sp., by C. M. Packard (p. 598); An Unusual Occurrence of *Thrips nigropilosus* Uzel on Cultivated Spearmint, by L. G. Gentner of the Michigan Experiment Station (pp. 598, 599); The Lethal Dose of Arsenic for the Newly-Hatched Codling Moth Larvae, by R. H. Smith (pp. 599, 600); Studies of Substitutes for Arsenate of Lead as a Soil Insecticide, by J. W. Lipp (pp. 600, 601); A Simple Method of Obtaining Moth Eggs, by S. E. Flanders (p. 601); The Control of the Tobacco Beetle in Upholstered Furniture (p. 602) and Sodium Fluosilicate as a House Fly Poison (p. 602), both by S. Marcovitch of the Tennessee Experiment Station; Successful Shipments of *Trichogramma minutum*, by H. Spencer (p. 602); The Eggplant Leaf-miner, *Phthorimaea glochinella* Zeller in Tomatoes Shipped from Mexico, by C. E. Mickel (pp. 602, 603); and Hibernation of the Striped Cucumber Beetle, by O. E. Gahn (p. 603).

[Scientific notes on economic entomology] (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 704-706).—The notes here presented include the following: The

Westward Spread of *Samia cecropia* (L.), by T. D. A. Cockerell (p. 704); Mexican Bean Beetle, *Epilachna corrupta* Muls., by E. P. Felt (p. 705); A New Material Used to Cage Insects on Their Host Plants, by L. M. Smith (p. 705); and Norway Maple Leaf Stalk Borer, by E. P. Felt (p. 706).

Some entomological problems (*Montana Sta. Rpt. 1928, pp. 32-36*).—This is a brief discussion of the problem of mosquito control in Montana, where there are 39 known species, and of cutworms, of which there are 500 known different forms in the State, with brief notes on oil sprays.

[Papers on economic insects and their control] (*Quebec Soc. Protect. Plants, Ann. Rpt., 20 (1927-28), pp. 9-16, 84-86, 92-130, pls. 2*).—The contributions here presented relating to economic entomology include the following: Forecasting Outbreaks of the Pale Western Cutworm and Army Cutworm in Alberta, by H. L. Seamans (pp. 9-11); Recent Advances in Insecticides, by W. H. Brittain (pp. 11-16); The Chief Injurious Insects of Vegetables and Ornamental Plants in the Montreal District in 1927, by J. Beaulne (pp. 84-86); and The Onion Root-Maggot (*Hylemyia antiqua* Meig.) on the Island of Montreal, by A. D. Baker and K. E. Stewart (pp. 92-130).

The studies of the biology and control of the onion maggot are reported in part in tabular form. There was found to be very little difference in the relative resistance of different varieties of onions to maggot attack under the conditions obtaining. It is concluded that the pH of a soil does not have any important influence on the degree of maggot infestation within such limits as would render the soil still suitable for the cultivation of onions. In 1925, 55 different baits were tested over periods of varying length, and the more successful were again tested in 1926. The best baits of 1925 were the sodium arsenite molasses, ferric chloride molasses, sodium fluoride molasses, and sodium cyanide molasses. In 1926 the sodium arsenite molasses, ferric chloride molasses, and sodium fluoride molasses baits gave the best results. A molasses solution was found to be more attractive to flies than a granulated sugar solution. Staphylinid and carabid beetles were the most important natural enemies of the onion maggot, frequently being very important factors in checking the natural increase of the pest.

A list of 37 references to the literature is included.

Insect enemies of 1928 [in Scotland], R. S. MACDOUGALL (*Highland and Agr. Soc. Scot. Trans., 5. ser., 41 (1929), pp. 137-177, figs. 30*).—This is the usual annual account of insects of importance during the year in Scotland (E. S. R., 61, p. 547).

Insects of Norway, I, L. R. NATVIG (*Norske Insekter. Oslo: Foranst. Zool. Mus., 1928, vol. 1, pp. 315, figs. 290*).—A small handbook in which the first or general part (pp. 15-119) is devoted to an account of the structure of insects. This is followed by a part on classification (pp. 121-290), in which 10 orders are dealt with.

[Work with economic insects in the Union of Socialistic Soviet Republics] (*Zashch. Rast. Vred. (Défense des Plantes), [Leningrad], 5 (1928), No. 5-6, pp. 443-571, figs. 39*).—The contributions relating to insects of economic importance in Russia include the following: *Rhynchites auratus* Scop. *ferganensis* n. subsp., an Enemy of Apricot in Ferghana, by V. P. Nevskii (Nevskij) (pp. 443-473); Contributions to the Biology of *Polla oleracea* L., by P. V. and L. M. Zorin (pp. 475-486); Notes on the Geographical Distribution of Cockchafers in the Province of Odessa, by D. V. Znoiko (Znojko) (pp. 487-495); *Biston strataria* Hufn. in the Government Forests of Voronezh, by I. A. P. Shehelkanotsev (J. P. Stshelkanovtzev) (pp. 497-503); Contributions to the Study of the Biology of *Polychrosis botrana* Schiff., by E. A. Amirashvili (pp. 505-514); Contributions to the Study of the Biology of Scolytids in the Govern-

ment of Bryansk, by P. Borodaevskii (Borodaevskij) (pp. 515-521); The Regularity in Propagation of the Pine Beetle *Blastophagus minor* Hartig, and the Basis for Its Control, by A. Il'inskii (Iljinskij) (pp. 523-542); An Account of *Carpophilus hemipterus* L. Attacking Bread and Other Stored Food Products in the Far East, by V. Engel'gardt (Engelhardt) (pp. 543-547); Results of Observations of *Harmolita eremitum* Portsh. in the Lower Volga District in 1926, by D. A. Ponomarenko (pp. 549-557); Contributions to the Biology of *Meligethes aeneus* Fabr., by L. Kozhanchikov (Kozhantshikov) (pp. 559-562); The Enemies of Buckwheat, by V. G. Pliginskii (Pliginskij) (pp. 563-567); and Atmospheric Deposits as Regulators of the Abundance of Caterpillars of *Euzoa segetum* Schiff. on Fall Rye in the Government of North Dvina, by Z. Azov (pp. 569-571).

Report of the chief entomologist for the year 1928, R. W. JACK (South. Rhodesia Dept. Agr. Rpt. Sec. 1928, pp. 39-46).—A brief practical account of the occurrence of the more important insect pests of the year under report (E. S. R., 60, p. 845).

The procession of foreign insect pests, G. W. HERRICK (Sci. Mo., 29 (1929), No. 3, pp. 269-274, figs. 3).—This is a practical account.

A progress report on the testing of sulfonated oxidation products of petroleum for their insecticidal properties, J. L. HOERNER (Maryland Sta. Bul. 310 (1929), pp. 447-465).—This is a report of work commenced at the Citrus Experiment Station at Lake Alfred, Fla., in December, 1927, and continued through May, 1928, at which time the work was transferred to the Maryland Station. In the course of the tests it was found that nicotine, at greatly reduced dilutions, could be used successfully against aphids by the addition of sulfonated oxidized gas oil in place of the usual spreaders, and the greater part of the work here reported is on such combinations. While the results varied a little in the individual tests, the sulfonated oxidation products of gas oil consistently gave better results than those prepared from oxidized kerosene with no apparent increase in toxicity to plant foliage. The choice between the sulfonated gas oil samples was quite difficult.

In reporting the work the name Penetrol is used to designate the oxidized gas oil sulfonated by the direct method. It was found that in dilute emulsion Penetrol will not separate appreciably on long standing. It has a characteristic odor which is not objectionable in either stock or spray. Concentrations as high as 4 per cent have been sprayed on painted surfaces with no injury. Samples that have been stored at ordinary temperatures for over a year will still emulsify readily in water. After over seven weeks in a refrigeration room at a temperature of -10° F., Penetrol emulsified readily in water after several minutes' thawing out at room temperature.

Tables are given which show the comparative results obtained (1) by spraying 2 species of aphids with the sulfonated oxidation products of petroleum, (2) by spraying 26 species of aphids with Penetrol-nicotine and soap-nicotine combinations, (3) by spraying 3 species of aphids with other combinations of Penetrol nicotine and soap nicotine, (4) by spraying leafhoppers with Penetrol-nicotine and soap-nicotine combinations, (5) by spraying thrips, *Heliothrips femoralis*, with Penetrol-nicotine and soap-nicotine combinations, (6) by spraying apple aphids, mostly the apple grain aphid, on Winesap trees with Penetrol, lime sulfur, and nicotine combinations, (7) in delayed dormant tests with lime sulfur and Penetrol lime sulfur on Winesap apple trees for foliage injury, (8) on peach borer larvae by spraying infested trees with Penetrol containing 0.5 gm. of paradichlorobenzene per cubic centimeter, (9) on the peach bark beetle adults by spraying infested trees with Penetrol-paradichlorobenzene com-

bination 0.25 gm. per cubic centimeter, and (10) on *Cyclocephala* larvae by soil treatment with Penetrol emulsified and a commercial carbon bisulfide emulsion.

In general, plant tolerance to Penetrol is far above the concentration needed for aphid control. A list is given of plants with the concentrations of Penetrol that have been tested on them. In a few of the tests slight spotting on violet, nasturtium, and sultan flowers occurred at 0.5 per cent concentration. Buds just about ready to open were not injured. Combinations of Penetrol with lead arsenate, Bordeaux, Paris green, and flowers of sulfur were tested on apple foliage with no injurious results.

In the early tests, the details of which are given in tabular form, most of the samples of sulfonated oxidized petroleum products gave uniformly satisfactory results on two species (*Aphis coreopsidis* and *A. spiraeicola*). The best results were obtained through the use of Penetrol, which has the following insecticidal properties: "(1) Toxic alone at 1 per cent concentration to several species of aphids; (2) toxic to aphids at 0.5 per cent concentration combined with nicotine 1 part to 4,000 or 5,000 parts by volume; (3) good wetting and spreading at 0.5 per cent concentration; (4) uniform and stable on standing under extremes of temperature; (5) compatible with lead arsenate, calcium arsenate, Paris green, flowers of sulfur, and Bordeaux; (6) questionable compatibility with lime sulfur as a summer spray, but safe in so far as tested for a delayed dormant spray; (7) reasonably safe on foliage; [and] (8) easy to measure and emulsify in water."

Reference is made to studies conducted by Inman, previously noted (E. S. R., 62, p. 151).

Pyrethrin I and II, [Parts I, II] (*Jour. Agr. Sci. [England]*, 19 (1929), Nov. 2, pp. 266-296, figs. 5; 3, pp. 433-437).—This is a report of work conducted at the Rothamsted Experimental Station, Harpenden, England.

I. *Their insecticidal value and estimation in pyrethrum (Chrysanthemum cinerariaefolium)*, F. Tattersfield, R. P. Hobson, and C. T. Gimmingham.—Pyrethrin I and II were isolated by the method of H. Staudinger and L. Ruzicka¹ from *C. cinerariaefolium* and both shown to be highly toxic to *Aphis rumicis*. Pyrethrin I was found to be the most toxic substance so far tested by the authors, and since it is about ten times as toxic to these insects as pyrethrin II it is concluded that it is mainly responsible for the contact insecticidal value of pyrethrum.

"Two microanalytical methods of determining the pyrethrin content are described. (1) By means of the acids after hydrolysis. (2) By means of the semicarbazone. . . . The analytical results obtained for a series of pyrethrum samples agreed with their observed insecticidal properties to *A. rumicis*. Comparisons of the pyrethrin contents, as estimated, with the results of direct toxicity experiments both on the pyrethrum samples and the pure pyrethrins, confirm the validity of the analytical methods. There was a significant and positive correlation, in the samples tested, between the amounts of pyrethrin I and II."

The data obtained were insufficient to show a significant correlation between the size of flower heads and the content of poison, or to draw conclusions as to the effect of external conditions such as soil, weather, or age of bed.

II. *Their estimation in pyrethrum (Chrysanthemum cinerariaefolium)*, F. Tattersfield and R. P. Hobson.—In this contribution the authors used the acid method to evaluate samples of pyrethrum derived from both Swiss and Japanese seed, with equally successful results. The rapid method of evaluation of pyrethrum by a determination of pyrethrin I is described.

¹ *Helvetica Chim. Acta*, 7 (1924), No. 2, p. 177.

The internal condition of the host plant in relation to insect attack, with special reference to the influence of pyridine (*Ann. Appl. Biol.*, 16 (1929), No. 3, pp. 453-471).—The first part of this account on the nature of the problems involved is dealt with by J. Davidson (pp. 453-464). The second part on soil treatment with pyridine and its effect on the infestation of *Vicia faba* by *Aphis rumicis* is reported upon by H. Henson (pp. 464-471).

Facilitating the removal of the spray residue, R. H. ROBINSON (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 693-698).—In this contribution from the Oregon Experiment Station a brief résumé, concluded from practical and laboratory observations, is given of the conditions that prevent the effective removal of spray residue by the chemical process.

Of the factors that retard the solvent action, the settling of dust on the lead arsenate in the calyx and stem end of apples appears most difficult to overcome. It is concluded that any compound or substance that is insoluble or only slightly soluble in water and yet very soluble in 0.5 per cent hydrochloric acid will best facilitate the removal of the residue by the acid treatment process. Calcium carbonate, calcium hydrate, and Bordeaux mixture have these properties. For practical use 1 or 2 lbs. of hydrated lime to each 100 gal. of lead arsenate spray should aid materially in the removal of the residue.

Contributions on cane pests (In *Report of the Committee on Cane Varieties, Diseases, and Fertilizers for the Sixth Annual Convention of the Philippine Sugar Association, 1928*. Manila: Philippine Sugar Assoc., 1928, pp. 65-82).—The contributions on sugar cane pests presented at the annual convention of the Philippine Sugar Association held at Manila include A Conspectus of Injurious and Beneficial Insects of Sugar Cane in the Philippines, with Special Reference to Luzon and Negros, by L. B. Uichanco (pp. 65-80), and A Program of Sugar Cane Insect Control, by W. D. Pierce (pp. 80-82).

Termite control in the Gulf States, T. E. SNYDER (*Miss. State Plant Bd. Quart. Bul.*, 9 (1929), No. 1, pp. 1, 2).—This is a practical contribution on control as applied to southern conditions.

Spraying for the control of onion thrips in Massachusetts, A. I. BOURNE (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 679-683, pl. 1).—In further work at the Massachusetts Experiment Station (E. S. R., 55, p. 254), the author has found a combined spray of nicotine sulfate and a soft, pourable potash fish-oil soap to give satisfactory control. Repeated sprays at from 7- to 8-day intervals were necessary to reach newly hatched young and migrants from near-by fields. A power sprayer adapted for the field spraying of onions that has been developed is said to have shown excellent promise.

The Coreidae of Kansas, H. O. DEAY (*Kans. Univ. Sci. Bul.*, 18 (1928), No. 5, pp. 371-415, pls. 3, fig. 1).—This account of the Coreidae includes a 6-page list of references to the literature.

Studies on the biology of Kansas Cicadidae, R. H. BEAMER (*Kans. Univ. Sci. Bul.*, 18 (1928), No. 2, pp. 155-263, pls. 16, fig. 1).—This report of studies includes a list of 45 references to the literature.

Study of the life history and spotting habits of *Eutettix chenopodii* (Homoptera, Cicadellidae), I. P. CARPENTER (*Kans. Univ. Sci. Bul.*, 18 (1928), No. 7, pp. 457-483, pl. 1).—This is an account of the biology of the species occurring on and causing a spotting of the leaves of *Chenopodium album*.

Leafhopper injury (*Kentucky Sta. Rpt. 1928, pt. 1, p. 31*).—A study of *Empoasca fabae* is said to have shown that this leafhopper is responsible for a great deal of injury to clovers and alfalfa, the injured leaves of clovers becoming yellowed or browned or taking on a pinkish, purplish, reddish, or bronzy cast. The injured leaves of alfalfa became yellowed. Infested clovers and alfalfa made much less growth than uninfested plants, and many of the plants

died from the effects of the feeding of leafhoppers. It was found that a single adult or nymph was able to kill a young plant. It was observed that the foreign clovers were much more severely injured than the native strains of red clover.

A biological method for destroying bedbugs, N. T. LORANDO (*Sci. Mo.*, 29 (1929), No. 3, pp. 265-268).—In observations made while engaged in work with the Near East Relief in Greece, a spider identified by [A.] Petrunkevitch as *Thanatos flavidus* Simon was observed to control the bedbug effectively, 30 or 40 bugs a day, according to their size and quantity of blood food, having been fed upon by this arachnid. Young spiders hatched out after an incubation of 18 days in summer immediately began to attack the bugs. Attention is called to a similar habit of the spider, as reported by Sambon (*E. S. R.*, 24, p. 757), who found them preying upon engorged stable flies.

The apple aphid and the citurs aphid: *Aphis pomi* DeGeer and *A. spiraeicola* Patch, E. M. PATCH (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 698, 699).—In this contribution from the Maine Experiment Station the author presents a list of certain food plants of the race of *A. pomi* overwintering on *Spiraea* and commonly known as the citrus aphid.

The aphid enemies of sugarcane in Peru [trans. title], G. N. WOLCOTT (*Entom. Erpt. Agr. Soc. Nac. Agr., Lima, Circ.* 12 (1928), pp. 11, fig. 1).—This is a brief practical account of the more important sugarcane aphids in Peru.

Acrostalagnus aphidum Oud. and aphid control, J. A. B. NOLLA (*Jour. Dept. Agr. Porto Rico*, 13 (1929), No. 2, pp. 59-72, pls. 2).—A report of studies of this fungus parasite of aphids. The parasite is known to attack aphids on 17 species of the higher plants, 8 of which have previously been reported and 9 are new additions.

Mealy bug (*Dactylopius longispinus*), a potential vine pest, F. DE CASTELLA and C. FRENCH, jr. (*Jour. Dept. Agr. Victoria*, 27 (1929), No. 7, pp. 427-433, figs. 2).—A mealybug identified as *D. longispinus* (Targ.) (*D. adonidum* (Sign.)), a widely distributed pest, especially in greenhouses, and often found in Mildura in suburban gardens, is a source of injury to the grape.

The cotton-square borer, H. J. REINHARD (*Texas Sta. Bul.* 401 (1929), pp. 36, figs. 4).—This is a report of studies of the life history and habits, with notes on the natural enemies of and control measures for *Strymon melinus* Hbn., one of the "hair-streak" butterflies, the larva of which commonly feeds upon cotton squares. The species extends over temperate North America. Although a very common one in Texas, it is not an especially injurious pest of cotton. In that State the larvae also feed commonly upon the seed pods of cowpeas, beans, okra, and to a lesser extent upon corn and goatweed (*Croton capitatus*).

The adults of the overwintering brood emerge during February and March. Oviposition begins soon thereafter and continues throughout the warm season. The eggs are laid singly and promiscuously upon the food plants. The incubation period during June and July, 1928, averaged about 5½ days. The larvae normally molt five times and require about 20 days during warm weather to attain full growth. Pupation occurs in the open, usually upon the food plant, and approximately 9½ days are required for pupal development during the summer months. The life history studies indicate that three complete generations or broods of *S. melinus* may be produced during a season in the latitude of Texas where the insect does not pass through a protracted hibernation period. The insect is dormant or semidormant throughout December and January, which period apparently is passed in both the pupal and adult stages.

Usually *S. melinus* is effectively held in check by natural enemies and combative measures rarely are required. When preventive work appears necessary, dry applications of calcium arsenate, 5 to 7 lbs. per acre, will produce

a satisfactory control, especially if the poison is applied while most of the larvae are still small.

Control of ragwort through insects: Experimental work with cinnabar moth, D. MILLER (*New Zeal. Jour. Agr.*, 39 (1929), No. 1, pp. 9-17, figs. 6; also in *New Zeal. Jour. Sci. and Technol.*, 11 (1929), No. 2, pp. 112-119, figs. 6).—This is a report of control work with ragwort in Australia, where the cinnabar moth (*Tyria jacobaeae*) was imported the preceding fall as a means of controlling this weed.

Banding for codling moth control, W. P. FLINT and C. C. GOFF (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 675-679).—In experiments conducted in 1927 tarred papers were found to be the best of the banding materials tested, as was the case in earlier tests (*E. S. R.*, 39, p. 865). Thus far data on the kill of codling moths on treated bands show a better kill to be obtained where the β -naphthol is dissolved in benzene and then added to the lubricating oil than where the β -naphthol is dissolved in the heated oil.

"Mixtures of 1 part monochloronaphthalene in 10 parts of lubricating oil and the same amounts of orthotoluidine gave better kills than any other materials tested here. Where these materials were used on crêpe paper bands and the bands allowed to remain on the trees for five months, severe injury resulted, especially with the monochloronaphthalene. The β -naphthol and oil gave some injury, but in no case was this severe enough to stunt the tree or apparently to cause any permanent injury."

A determination of the lethal dosage of arsenic for Missouri and Colorado codling moth larvae, L. HASEMAN and V. F. BURK (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 655, 656).—In order to determine the comparative susceptibility of native Missouri and Colorado codling moth larvae to arsenic, a careful feeding experiment was undertaken at the Missouri Experiment Station, in which 2 bu. of wormy apples were received from western Colorado. The worms were taken from the apples and grouped into classes according to size. Similar classes of native worms were selected from home grown apples and treated in the same way.

These limited tests indicate that the Colorado codling moth larvae have not developed a resistance to arsenic greater than that of native Missouri worms under the same conditions, and if there be any difference it appears to be in favor of Missouri worms.

Codling moth bait trap studies, L. F. STEINER (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 636-648).—In work at the Indiana Experiment Station a low grade solution to which geraniol had been added proved the most attractive bait for codling moths among the large number of ferments, aromatic chemicals, and ferment-chemical combinations tested during 1927 and 1928. It was found to be particularly attractive during the dry summer months. Aromatic chemicals used alone were of no value under Indiana conditions.

"The use of bait traps as a supplementary control was proven uneconomical where the injury can be held to 10 per cent or less by banding, orchard sanitation, or other means, since it cost \$86.00 to produce 80 bu. more clean fruit in a 12-acre experiment. The results secured, however, are promising enough to warrant further tests in more heavily infested orchards. Bait traps captured more individuals than did bands. Females outnumbered males during the summer months, but in cool weather more males were captured. Many eggs were deposited despite the fact that 95 per cent of the females were gravid or partly so. Unless the trap was exposed more eggs were deposited on baited trees than on those containing no traps.

"Position of the trap was as important a factor in determining its efficiency as the attractant it contained. The best traps were located in the extreme

top of trees or high up on the outside, were exposed rather than hidden by foliage, and were located in the higher parts of the orchard. Without sufficient exposure many pans, otherwise properly located, caught few or no moths."

Miscellaneous codling moth studies, L. F. STEINER (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 648-654).—In work at the Indiana Experiment Station only 3 per cent of the larvae captured in bands treated with β -naphthol completed their life cycle and emerged as moths. Field tests and behavior studies indicate that this chemical repels from 10 to 20 per cent of the larvae. α -naphthylamine (Techn.) used in a similar manner gives promise of being as effective as β -naphthol.

"Corrugated strawboard proved the best material for chemical treatment, while combination burlap and kraft paper is more efficient than burlap, crêpe, or tar paper where untreated bands are used. Thickness was found to be an important factor in determining the efficiency of any banding material. Mature larvae are attracted to upright objects and find the tree readily in daylight but only by accident at night. Although able to successfully hibernate in leaves and in sod, larvae will not readily do so if coarse debris is present or if adequate cocooning quarters such as bands are available on the trunk. Small shrubs and bits of dead weed stems in the absence of coarse debris furnished attractive cocooning quarters for larvae. Larvae can live in buried apples for at least seven weeks, and before the soil is too solidly packed can escape through 6 in. of it."

Hydrated lime in summer sprays for the control of the oriental fruit moth, L. A. STEARNS and R. B. NEISWANDER (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 657-660, pl. 1).—This is a preliminary account in which the authors report that the results obtained in laboratory tests and orchard spraying experiments conducted in Ohio during 1928 indicate that heavy applications of hydrated lime either alone or in combination with insecticides offer promise as a control for the oriental fruit moth (*Laspeyresia molesta* Busck). Such sprays act as a physical and mechanical hindrance to oviposition, hatching, and larval entry. In one orchard, the main crop variety Elberta was harvested with 91 per cent marketable and 85 per cent absolutely clean fruit, a reduction of 47 per cent in injured fruit and a decrease of 76 per cent in infestation in favor of the experimental treatment.

A bibliography of the European corn borer (*Pyrausta nubilalis* Hbn.), J. S. WADE (*U. S. Dept. Agr., Misc. Circ. 46. rev. and enl. (1928), pp. 35*).—This revision of the bibliography of 1925 (*E. S. R.*, 54, p. 55) includes 330 additional titles, a total of 914. All of the more important available references, both to European and American literature, issued previous to January 1, 1928, are included.

Pyrausta nubilalis Hubn. in Europe: Notes on infestation and parasitism from 1926 to 1928, H. L. PARKER, A. M. VANCE, H. D. SMITH, and W. GAMKRELIDZE (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 688-693).—Supplementing U. S. D. A. Technical Bulletin 59 (*E. S. R.*, 59, p. 354), subsequent data are assembled covering the years 1926, 1927, and 1928. These include records of percentages of infestation by the European corn borer, additional records of the distribution of its parasites, parasitism by species and zone for the three years mentioned, new determinations of corn borer parasites, and records of secondary parasites.

Attempts to protect sweet corn from infestations of the corn ear worm, *Heliothis obsoleta* (Fabr.), S. B. FREEBORN and F. H. WYMORE (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 666-671).—In work at the California Experiment Station the authors tabulated the stage of development of approximately 10,000 ears of sweet corn of two varieties at the time of treatment.

"The results when the ears reached market maturity suggest that extra light sodium fluosilicate (70-75 per cent) and a Japanese pyrethrum extract were the most effective insecticides, while ordinary black pepper proved to be a very satisfactory moth repellent. The results with arsenates and various nicotine combinations, including the new nicotine caseinate, were not impressive. Biological observations support the thesis that the larvae migrate from ear to ear, and that the loose silk (which receives the coating of dust or spray) is not eaten by the entering larva. It is assumed that the fluosilicates kill by contact or by producing an irritation that impels a cleaning process on the part of the larva after its progress through the dust laden silk."

The bud moth in western New York. S. W. HARMAN (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 660-662).—The eye-spotted bud moth has appeared in western New York as a major apple pest. In 1928 trees were defoliated early in the season, over 50 per cent of the fruit being injured in a number of instances. Summer spraying reduced the injury but left an excess of arsenical residue on the fruit. Moths were killed with nicotine dust and caught in bait and light traps.

Egg-laying capacities of malaria mosquitoes. H. W. B. MOORE (*Agr. Jour. Brit. Guiana*, 2 (1929), No. 2, pp. 69-75).—The author reports that the egg-laying capacity of two anopheline mosquitoes, namely, *Anopheles tarsimaculata* Goeldi and *A. argyritarsis* R. D., averages from 900 to 1,000 per individual.

On the influence of the wind in the spread of *Anopheles maculipennis*. N. H. SWELLENGREBEL (*Amer. Jour. Hyg.*, 10 (1929), No. 2, pp. 419-434, figs. 4).—It is concluded that wind as a means of transport in the direction in which it is blowing is of more importance in the spread of *A. maculipennis* than may be gathered from the current literature. A list of 27 references to the literature is included.

Two fungus parasites of *Anopheles maculipennis* Mg. [trans. title], V. CHORINE and B. BARANOFF (*Compt. Rend. Soc. Biol. [Paris]*, 101 (1929), No. 25, pp. 1025, 1026).—Two fungus parasites causing the death of the larvae of *A. maculipennis* observed in the vicinity of Zagreb, Hungary, are referred to. The transmission takes place through mobile zoospores—the propagation of which is limited to some extent by Infusoria that attack them.

On transmission of the virus of yellow fever by excreta of infected mosquitoes [trans. title], H. DE BEAUREPAIRE ARAGÃO and A. DA COSTA LIMA (*Mem. Inst. Oswaldo Cruz, Sup.* 8 (1929), pp. 101-108, pl. 1; *Eng. trans.*, pp. 105-108).—From the experiments conducted it is concluded that the defections of infected mosquitoes are equally as effective as their bite.

Further studies on *Chara* spp. and other aquatic plants in relation to mosquito breeding. R. MATHESON and E. H. HINMAN (*Amer. Jour. Trop. Med.*, 9 (1929), No. 4, pp. 249-266, figs. 5).—This is a report of studies conducted in continuation of those previously noted (*E. S. R.*, 59, p. 356).

The authors find that *C. fragilis*, growing in still and running water aquaria of various kinds, prevents mosquito breeding. In the presence of decay oviposition takes place and larval development proceeds normally, but if the plant recovers its vigorous growth decay ceases, larval growth is inhibited, and oviposition does not occur. In all of the ponds, lakes, etc., examined in a limited survey of the central New York area where a vigorous growth was found no mosquito breeding was observed, with one exception.

The Hessian fly in Pennsylvania. C. C. HILL and H. D. SMITH (*Penn. Dept. Agr. Bul.* 481 (1929), pp. 11, figs. 14).—Following a brief description and an account of the life history and habits of the Hessian fly, the authors deal with the nature of the injury, the history of the Hessian fly in Pennsylvania from

1921 to 1928, and the extent of infestation in 1928, and refer to its parasites and methods of control.

Another insect friend, B. A. OSTERBERGER (*Sugar Bul.*, 7 (1929), No. 11, pp. 11, 12).—A contribution from the Louisiana Experiment Stations in which reference is made to a robber fly, the larvae of which destroy *Ligyris* beetle grubs.

Observations on the carrot rust fly (*Psila rosae* Fab.) in Massachusetts, W. D. WHITCOMB (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 672-675).—As noted in this contribution from the Massachusetts Experiment Station, preliminary experiments with several insecticides showed promising results with Derris compounds, corrosive sublimate, and sodium fluosilicate against the first generation. It was found that the attack of the first-generation larvae can be avoided by planting about three weeks before the "fly-free date."

The onion maggot situation in New York, H. GLASGOW and H. T. COOK (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 683-688, pl. 1).—The authors report that of the various methods which have been suggested for the control of the onion maggot (*Hylemyia ceparum*) the lubricating oil Bordeaux sprays are at present the most promising, when cost, efficiency, and ease of application are considered. With the perfection of the small tractor sprayers this method has developed into a thoroughly practical and economical means of maggot control. In addition to their insecticidal properties these sprays have also proved of value in checking the development of weeds in sprayed fields, while at the same time causing no serious permanent injury to the crop.

The study of *Braula coeca*, A. G. BELLAVSKY (*Bee World*, 10 (1929), No. 6, pp. 84-87, figs. 11).—A report of studies of this dipterous enemy of the honeybee conducted near Novochoerkask, Russia, presented in connection with a list of 30 references to the literature.

A rat-flea survey of Peking, M. HERTIG and T. F. HUANG (*Amer. Jour. Hyg.*, 10 (1929), No. 2, pp. 521-525).—In a rat-flea survey of Peking, China, extending throughout one year, in which 6,286 rats were examined, the oriental rat flea (98 per cent) and *Ceratophyllus anisus* (2 per cent) were the only rat fleas found. The average number of oriental rat fleas per rat was 1.33 for the whole year, with a maximum of 3.10 in August and a minimum of 0.30 in February.

Hibernation of the striped cucumber beetle (Coleop.: Chrysomelidae), W. V. BALDUF (*Ent. News*, 50 (1929), No. 8, pp. 260-262).—The author reports upon observations of 59 living adults of the striped cucumber beetle in what seems to be its natural habitat for hibernation in Illinois. All these individuals occurred under 2 in. of foliage of trees within an area of 2 sq. ft. around the base of an ash seedling some 3 ft. high.

Contribution to the golden spider-beetle problem [trans. title], F. ZACHER (*Anz. Schädlingssk.*, 5 (1929), No. 3, pp. 29-37, figs. 7).—In this account of *Ptinus hololeucus* Fald. the author reports at length upon the geographical distribution and occurrence of this pest. This is followed by a summary of information on its bionomics, presented in connection with a list of 92 references to the literature.

Thermotropism of the Mexican cotton boll weevil, E. F. GROSSMAN (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 662-665).—The author describes a new apparatus devised at the Florida Experiment Station for determining the thermotropic reaction of insects. The boll weevil showed definite orientation in response to 26° F. at the chilled and 130° at the heated end of the apparatus, respectively.

The chestnut curculios, F. E. BROOKS and R. T. COTTON (*U. S. Dept. Agr., Tech. Bul.* 130 (1929), pp. 24, pls. 6, fig. 1).—This is a report of studies of the two curculios which attack chestnuts and chinquapins in the United States,

known as the larger chestnut curculio (*Balaninus*) *Curculio proboscideus* Fab., and the lesser chestnut curculio, *C. auriger* Casey, extending over a period of seven years. Both of these species are native to North America and are found over practically the entire range of the native chestnut and the common and alder-leaved chinquapins. It is pointed out that in many localities curculios often destroy from one-half to three-fourths of the chestnut crop, and that occasionally even a greater proportion of the nuts are ruined.

The life cycle of *C. proboscideus* covers a period of one year, a few individuals of each generation requiring two years to complete the cycle, while that of *C. auriger* covers two years, a few individuals of each generation requiring three years to complete the cycle. The beetles of *C. proboscideus* appear on the trees at the time the burs are approaching full growth and deposit their eggs in holes drilled through the spiny covering into the flesh of the nuts. The grubs hatching from the eggs feed in the nuts, and, when full grown, enter the ground, where they make cells a few inches beneath the surface and pass the winter as larvae. The following summer they pupate and then change to beetles in time to issue and attack the growing nuts. The beetles of *C. auriger* issue from the ground in the spring before chestnut trees come into bloom. They spend the summer in comparative inactivity among the branches of trees, and, when chestnuts and chinquapins begin to ripen, collect on the burs, and mate there, the females then laying eggs in the nuts of the opening burs. The larvae enter the ground late in the fall, spend the winter and the following summer in their earthen cells, then pupate and change to beetles in the fall. The beetles remain within their pupal cells until spring and then issue and seek the trees.

Among the natural enemies of these curculios are gray squirrels, shrews, several species of birds, spiders, ants, two species of dipterous parasites (*Winthemia quadripustulata* Fab. and *Myiophasia nigrifrons* Tns.), and the hymenopterous parasite *Urosigalphus armatus* Ashm., which is of considerable importance in some localities in reducing the number of curculios. These curculios are difficult to control. The larvae may be killed by subjecting the nuts to cold or heat treatments and by fumigation with carbon disulfide. Spraying experiments have shown that curculio injury to chestnuts may be reduced by the use of arsenical poisons applied to the trees in late summer and fall, but it is questionable whether sufficient benefit will be obtained to justify the labor.

Bee-keeping in Palestine and Egypt compared, June, 1927, J. E. M. MELLOR (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 82* (1929), pp. 17, pls. 18).—A practical comparison of beekeeping in Palestine and Egypt.

Note on the infection of bee larvae by *Bacillus* larvae [trans. title], K. TOUMANOFF (*Bul. Acad. Vét. France, 2* (1929), No. 1, pp. 44-49).—This paper, preceded by an introductory account by M. Henry (pp. 44, 45), reports briefly upon some infection experiments with American foulbrood, the details being presented in tabular form.

The larch sawfly as an indicator of mouse abundance, S. A. GRAHAM (*Jour. Mammal., 10* (1929), No. 3, pp. 189-196).—The author has found that mice open and destroy an average of 60 per cent of the larvae of the larch sawfly that succeed in spinning cocoons, being one of the most important factors of environmental resistance tending to hold the pest in check. Comparable results are said to have been obtained by both random collecting of cocoons and more systematic collections made on sample plats. Cocoons opened by mice may readily be distinguished by the marks of the incisor teeth along the edge of the opening made in the cocoon. In eating a larva taken from a cocoon a mouse consumes only the soft internal parts, leaving the skin and

hard parts. Thus this type of food would not be evident in the stomach examinations.

Trichogramma experiments in 1928 for control of the sugarcane borer, W. E. HINDS and H. SPENCER (*Jour. Econ. Ent.*, 22 (1929), No. 4, pp. 633-636).—This is a report of work conducted at the Louisiana Experiment Stations in continuation of that previously noted (E. S. R., 59, p. 461).

"Using *Sitotroga cerealella* as host, more than 16,000,000 parasites of the species *T. minutum* Riley were reared in the laboratories of the Louisiana Experiment Station. These parasites were used experimentally in fields of corn and sugarcane for control of the sugarcane borer, *Diatraea saccharalis*. Colonizations of *Trichogramma* during June, 1928, in five localities resulted in marked increases in percentages of *Diatraea* eggs parasitized."

Observations on some hymenopterous parasites of Coccidae in the Mediterranean Basin [trans. title], R. POUTIERS (*Rev. Path. Vég. et Ent. Agr.*, 15 (1928), No. 9, pp. 267-270).—Notes are presented on the parasites attacking *Chrysomphalus dictyospermi* Morg., *Aspidiotus hederæ* Vallot, euonymus scale, *Chionaspis bambusæ* Ckll., rose scale, white peach scale, and *Diaspis zamiae* Morg.

Tar-distillate washes and red spider, A. M. MASSEE and W. STEER (*Jour. Min. Agr. [Gt. Brit.]*, 36 (1929), No. 3, pp. 253-257, pl. 1).—The fact that tar-distillate washes were used on fruit trees for several years in succession and red spider had become more abundant and frequently an important pest is thought to be due to the effect upon parasitic and predacious enemies which normally check the red spider. In this account the authors report upon observations made of *Anthocoris nemorum*, a small predatory bug which commonly feeds on red spiders and their eggs.

ANIMAL PRODUCTION

Supplementary energy-production coefficients of American feeding stuffs fed ruminants, G. S. FRAPS (*Texas Sta. Bul.* 402 (1929), pp. 18).—The results of 41 digestion experiments, together with a compilation of other American digestion studies supplementary to those previously noted (E. S. R., 54, p. 60), are published in this bulletin. Based on the new data, supplementary revisions are given of production coefficients. The digestion experiments reported herein are for alfalfa hay and meal, barley, broomcorn seed, cotton burs, cottonseed hulls, cottonseed meal, flax plant by-product, goose grass, guar hay, linseed meal, mesquite grass, milo, peanut hulls, prairie hay, rice bran, rice hulls, rice polish, wheat, wheat bran, wheat gray shorts, and wheat brown shorts.

Yield and composition of pasture grass, H. B. ELLENBERGER, J. A. NEWLANDER, and C. H. JONES (*Vermont Sta. Bul.* 295 (1929), pp. 68, pls. 12, figs. 11).—Records of the rate of growth, total yields, pasture yields, and composition of the forage on 14 Vermont pastures were obtained for the 3 pasture seasons of 1924 to 1926. It was found that growth increased gradually during May, reached a maximum in early June, decreased to the middle of July, increased again to the middle of August, and then rapidly declined.

The average total acre yield was 7,798 lbs. of forage, which on the average contained 1,748 lbs. of dry matter. Clipping analyses on a dry-matter basis taken at monthly intervals showed a rather uniform seasonal composition, approximating 12 per cent of crude ash, 20 per cent of crude protein, 19 per cent of crude fiber, 46 per cent of nitrogen-free extract, 3 per cent of ether extract, 0.82 per cent of calcium, and 0.32 per cent of phosphorus. It was calculated that the net acre yield of eaten dry matter averaged 1,389 lbs. and of total digestible nutrients 956 lbs.

Most of the pastures were capable of supporting per acre a 1,000-lb. cow, producing 20 lbs. of 4 per cent milk, for 65 days. Quantity rather than quality appeared to be the limiting factor affecting the carrying capacity of these closely grazed pastures. The nutrients in the forage on these pastures, especially when closely grazed, resembled those of a concentrate more than a roughage.

The utilization of nitrogen from a mixed ration in relation to the amount of feed and carbohydrate supplement [trans. title], A. P. DMITROCHENKO (DMITROTCHENKO), N. K. GLINKA, and M. V. SLETOVA (*Trudy Otd. Zootekh. Gosud. Inst. Opytn. Agron. [Leningrad] (Works Bur. Anim. Indus., State Inst. Expt. Agron.)*, 2 (1927), pp. 49-79, fig. 1).—In this study 2 bull calves 3 months old were fed for 8 weeks. During the latter half of the period they received 20 per cent more feed than is required by the Kellner standard. The results showed that the excessive feeding caused an increase in the utilization of nitrogen, and this was true whether the increase consisted of carbohydrates or a supplementary feed of the usual ration.

Problems in wintering beef cattle (*Montana Sta. Rpt. 1928, pp. 23, 24*).—Continuing this study (E. S. R., 59, p. 66), 5 lots of 10 cows each, except lot 5, which had 9 cows, were fed for 119 days, beginning November 18, 1927. Alfalfa hay, oat hay, sweetclover hay, corn fodder, and bluejoint hay were fed in the respective lots. The average winter gains were 41, 53.9, 53.4, 61.3, and 40.8 lbs. per head, obtained at an outlay of 2,202, 2,105, 2,311.5, 4,045, and 2,270 lbs. of hay, respectively. When alfalfa was worth \$10 per ton the values of the roughages, not considering the gains, were \$10, \$10.46, \$9.52, \$5.44, and \$9.70.

Steer feeding [at the Kentucky Station] (*Kentucky Sta. Rpt. 1928, pt. 1, p. 21*).—Continuing this study (E. S. R., 60, p. 256), steers fed corn during the winter and finished on grass without corn made a total gain of 364 lbs. per head, while the average total gain of steers fed roughage during the winter and finished on grass with corn was 394 lbs. per head. On the basis of selling price both lots of cattle attained the same degree of finish, but the steers fed corn on grass returned \$5 per head more than those fed corn during the winter. There was little difference in the dressing percentage and carcass quality of the two lots.

Feedlot rations for fattening calves, E. J. MAYNARD and H. B. OSLAND (*Colorado Sta. Press Bul. 70 (1929), pp. 11, figs. 5*).—Continuing these studies (E. S. R., 60, p. 68) with steer calves averaging 352 lbs. per head and heifer calves averaging 323 lbs. per head the same rations and the same arrangement of lots were used in a 203-day test. The maximum allowance of cottonseed cake in this test was 1 lb. per head, and a mineral mixture of 50 per cent of steamed bone meal, 30 per cent of lime cake, and 20 per cent of salt was self-fed in each lot in addition to salt fed separately. The average daily gains, based on market weights, were 1.89, 1.54, 1.8, 1.87, 1.81, and 1.89 lbs. per head in the respective lots.

In this test each ton of ensiled beet pulp replaced 148.4 lbs. of barley, 3 lbs. of cottonseed cake, 280.3 lbs. of alfalfa, and 1 lb. of mineral mixture, but required 0.9 lb. more salt. Each ton of pressed beet pulp ensiled at the feed lots replaced 169.1 lbs. of barley, 2.7 lbs. of cottonseed cake, 265.5 lbs. of alfalfa, and 0.4 lb. of mineral mixture. While corn silage did not prove to be as efficient or as economical as wet beet pulp, it could be used to advantage to supplement a limited supply of pulp for increasing the number of calves fed. Each ton of beet tops fed replaced 439.4 lbs. of barley, 5.5 lbs. of cottonseed cake, 262.1 lbs. of alfalfa, and 2.45 lbs. of minerals, but required 1.7 lbs. more

salt. With the basal ration used, beet tops made too narrow a ration to produce optimum gains. The steer calves gained 70.6 lbs. more in weight than the heifers, and at a feed cost of 61 cts. per hundredweight less.

To compare trench and straw silos for storing pressed beet pulp, approximately one-half of 304.5 tons of beet pulp was stored in a silo of each type. In the trench silo 29.21 per cent and in the straw silo 26.89 per cent of the amount stored was lost for feeding purposes. However, the cost of equipment for construction was so much greater for the straw silo that the trench silo is deemed more desirable in spite of the increased loss in feed.

Improving cattle in areas freed of ticks, J. R. MOHLER (*U. S. Dept. Agr. Leaflet 51* (1929), pp. 8, figs. 6).—A popular publication intended for cattle owners in tick-free areas of the South, with practical suggestions for improvement of cattle through better breeding and feeding methods. Suggestions are also presented on purchasing and marketing cattle.

Seasonal variation in the iodine percentage and dry weight of the thyroid glands of sheep in Australia, M. C. DAWBARN (*Aust. Jour. Expt. Biol. and Med. Sci.*, 6 (1929), No. 1, pp. 65-77, figs. 8).—A distinct seasonal variation in the percentage of iodine in the thyroid glands of sheep was shown from analyses of the dry weight and iodine content of 106 thyroid glands collected over a 9-month period in the western district of Victoria. The average percentage of iodine of the glands collected during the Australian spring and early summer months (September, October, and November) was about 25 per cent less than the average of glands collected during the six preceding months. A corresponding but less marked rise in the dry weight of the glands occurred.

Charts and tables present the detailed results of the analyses.

Acidosis of pregnant ewes (Kentucky Sta. Rpt. 1928, pt. 1, pp. 20, 31).—The average calcium, potassium, and phosphorus content per 100 cc. of blood serum of 10 pregnant ewes was found to be 9.7, 27.4, and 7 mg., respectively. In the blood serum of 7 ewes at parturition time, the average content was 9.1 mg. of calcium, 22.5 mg. of potassium, and 5.1 mg. of phosphorus, while in the blood serum of 13 pregnant ewes suffering from acidosis these elements were present in quantities of 6.6, 44.1, and 5.7 mg., respectively.

In further work on this study 2 lots of 5 ewes each were fed as follows: Lot 1, 3 lbs. of a mixture of corn, bran, and linseed oil meal 3:3:1, with alfalfa hay per head daily, and lot 2, 1 lb. of a mixture of corn and oats 1:1, with corn stover and poor-quality timothy hay. After 5 months' feeding the average calcium, potassium, and phosphorus content in lot 1 was 10.2, 23.3, and 5.7 mg., and in lot 2, 7.5, 23, and 6.8 mg. of the respective elements.

Hog millet, corn, and barley in fattening rations for pigs, E. J. MAYNARD and J. F. BRANDON (*Colorado Sta. Press Bul. 69* (1929), pp. 8, figs. 3).—In this experiment 4 lots of 10 pigs each, averaging approximately 73 lbs. per head, were self-fed free choice for 125 days. The basal ration consisted of a protein mixture composed of tankage, cottonseed meal, and alfalfa meal, 2:1:1, a mineral mixture composed of lime cake, spent bone black, and salt, 40:40:20, and salt fed separately. In addition shelled corn, ground barley, ground millet, and ground millet and ground corn, equal parts, were fed in the respective lots.

Based on market weights, the average daily gains in the respective lots were 1.55, 1.45, 1.71, and 1.71 lbs. per head. In palatability the grains ranked as follows: Ground millet, ground millet and ground corn, shelled corn, and ground barley. To produce a unit of gain 17.7 per cent more barley than corn was required, but 11.6 per cent less protein and 33 per cent less minerals when the barley was used. At the existing prices of the two grains, barley had 88.1 per cent the value of corn. For each unit of gain 5.9 per cent more ground millet than corn was required, but with millet feeding 31.1 per cent less pro-

tein and 50 per cent less minerals were used. Based on these results, millet had 103 per cent the feed replacement value of corn. As compared with corn the millet-corn mixture required 5.1 per cent more grain but 41 per cent less protein and 42 per cent less minerals per unit of gain. The feeding of the millet-corn mixture did not produce as high returns as straight millet feeding.

In dressing percentages the lots ranked as follows: 3, 4, 1, and 2, and the same ranking prevailed in regard to shrinkage in the cooler. A cooking test indicated that the pork from millet-fed hogs had an excellent flavor, and the cured hams were graded as very good.

Hog feeding [at the Kentucky Station] (*Kentucky Sta. Rpt. 1928, pt. 1, p. 21*).—During a 49-day feeding period a lot of hogs, fed ear corn on a platform, gained at the rate 1.67 lbs. per head daily and required 5.27 lbs. of corn per pound of gain. A second lot, receiving ear corn from a self-feeder mounted on a platform, made average daily gains of 1.65 lbs. per head and consumed 5.7 lbs. of corn per pound of gain. A third lot, fed ear corn in the mud, gained 1.55 lbs. per head daily and required 6.26 lbs. of corn per pound of gain.

Report on pig-feeding trials carried out at the County Council Farm, Hutton, and some notes on pig-feeding, J. J. GREEN (*Lancaster Co. Council Ed. Com., Agr. Dept., Farmers' Bul. 45 (1928), pp. 45*).—The results of several experiments with pigs are reported in the first two sections of this publication. These tests were to determine the value of fish meal, whey, palm kernel cake, and milk as feeds for swine, and the advisability of substituting soybean meal and whale meal for fish meal. In the third section, methods of feeding and management which, as a result of the above experiments, have been successfully adapted at the farm are outlined.

The utilization of mill and slaughterhouse waste by pigs [trans. title], V. P. NIKITIN and N. V. TATARINOVA (*Trudy Otd. Zootekh. Gosud. Inst. Opytn. Agron. [Leningrad] (Works Bur. Anim. Indus., State Inst. Expt. Agron.), 2 (1927), pp. 80-103*).—Experiments with young pigs showed that they made good gains on waste from buckwheat flour or on wall sweepings supplemented with linseed oil cake or dried blood. Best results were obtained when 23 per cent of the ration consisted of linseed oil cake, and such a ration did not affect the quality of the lard as shown by the melting point and the iodine number of the fat. The buckwheat flour waste fed alone was quite palatable and had a good digestibility coefficient, but the mill wall dust alone was not satisfactory.

Domestic slaughtering, cutting, and curing of pork, H. H. SMITH (*Utah Sta. Circ. 80 (1929), pp. 20, figs. 6*).—A practical publication presenting methods for the killing, dressing, and cutting of hogs, and the curing and preparation of pork products on the farm.

[Poultry experiments at the Kentucky Station] (*Kentucky Sta. Rpt. 1928, pt. 1, pp. 24-28*).—The results of experiments, in continuation of those previously noted (*E. S. R., 60, p. 261*), are reported.

Metabolism in the chicken.—To a ration of ground yellow corn, wheat middlings, cod-liver oil, salt, 80:20:2:1, and skim milk were added pure calcium carbonate and tricalcium phosphate in ratios varying from 0:0 to 5:5 parts in five lots of White Leghorn chicks. Lots receiving the minerals in ratios of 2:2 or more grew at the same rate, but retarded development was shown in the lots receiving smaller amounts. The percentage of calcium in the dry leg bones of the chicks remained practically constant throughout the test, but the percentage of ash was higher in the lots receiving the 2:2 or more ratio than those receiving smaller amounts.

Tricalcium phosphate fed alone or with calcium sulfate or calcium carbonate caused increased growth and leg-bone development of chicks, but had no significant effect on the ash content of the bone or on the percentage of calcium

and phosphorus in the ash. Calcium carbonate and calcium sulfate served equally well as sources of calcium, while tricalcium phosphate supplied both the calcium and phosphorus. A yellow corn-wheat middlings-skim milk ration supplied enough phosphorus to supplement that in the absorbed egg yolk for the growth of White Leghorn chicks for the first 3 weeks.

When fed with a ration of ground yellow corn, wheat middlings, dried skim milk, cod-liver oil, and salt, bone meal, bone meal and limestone, or rock phosphate produced better growth and bone development than dicalcium phosphate or calcium carbonate.

The arterial blood of two laying hens contained 17.6 and 23.2 mg. of calcium and the venous blood 18.8 and 25.4 mg. per 100 cc. of blood serum. The blood serum of a nonlaying hen contained 17.75 mg. of calcium in the arterial blood and in the venous blood 17.83 mg. of calcium per 100 cc. This work suggests that calcium is taken into the blood stream directly from the materials in the intestines, and that the calcium of the blood serum varies between narrow limits for individuals.

A study of the hydrogen-ion concentration of the sexual organs and some of their secretions of White Leghorns shows that the semen of the mature male is 7.3, of the "bloom-secreting" part of the oviduct of the laying hen 5.8 to 5.9, of the eggshell membrane-secreting part 5.6 to 5.9, of the "albumin-secreting" part 6.3 to 6.6, and of the funnel 6.3 to 6.4. The pH of egg albumin, when immediately removed from the mucosa, lies between 6.7 and 6.8, and increases to 8.8 at 3 weeks. In the nonlaying hen the pH value of the mucosa of the funnel and albumin-secreting part are the same as in the laying hen, but the eggshell membranes, the shell, and the bloom-secreting membrane are distinctly more acid in the laying hen. This suggests that changes in acidity are directly connected with shell development and its membrane.

Effect of vitamin D supplements on eggshell thickness.—Thin or soft-shelled eggs were produced on rations adequate in all respects except that the vitamin D content was deficient. There was no significant relationship between the size and shape and the thickness of eggshell. It was found that certain hens inherited an inability to produce heavy eggshells even under optimum conditions.

All mash for laying hens.—Barred Plymouth Rocks fed an all-mash ration had an average egg production of 187.4 per head for the year and 54.6 of these eggs were produced during the winter. In comparison a similar lot of birds fed mash and grain produced 174.8 eggs per head during the year and 54.7 were laid during the winter season. White Leghorns on an all-mash ration laid 162.7 eggs during the year and 59.4 eggs during the winter, while those fed mash and grain produced 182 eggs during the year and 55.4 eggs during the winter.

Rate of feathering.—Observations on Barred Plymouth Rock chicks for a period of 3 years showed that the rate of feather development over the back is closely related to the rate of growth, the heavier chicks feathering more rapidly. The female chicks which feathered slowly over the back were poor winter producers while the chicks that feathered rapidly during the first 3 months were heavy producers. Exhibition-bred chicks grew slowly and were more inclined to be slow feathering than production-bred chicks. It was found that the best quality of barred feathers grew more slowly than the poor-quality feathers.

[Poultry studies], J. B. THOMPSON (*Virgin Islands Sta. Rpt. 1923, p. 4*).—A comparison was made of the egg production during the first laying year of 15 White Leghorn hens and 60 hens of common native stock. The native hens had an average production of 108.6 eggs, weighing 10 lbs. 5 oz., while the average production for the White Leghorns was 144.5 eggs, weighing 16 lbs. 1 oz.

Difficulties have been experienced in raising White Leghorn chicks in this climate, while the native birds were better able to withstand local conditions. As an indication of what selective breeding might do for the native hens, the average of the five highest records in the above lot of birds was 166 eggs per bird per year, weighing 16 lbs. 1 oz.

New Mexico egg storage studies, Part I, A. L. WALKER, L. N. BERRY, and E. E. ANDERSON (*New Mexico Sta. Bul. 177* (1929), pp. 47, figs. 12).—This is a more detailed account of work previously noted (E. S. R., 61, p. 261).

DAIRY FARMING—DAIRYING

[Experiments with dairy cattle at the Montana Station] (*Montana Sta. Rpt. 1928*, pp. 44-46).—Continuing the irrigated pasture studies (E. S. R., 54, p. 167), a grass mixture known as the Huntley pasture-grass mixture was found to have a carrying capacity of 2.2 cows per acre for a 4.6-months pasture season. An annual top-dressing of barnyard manure increased the carrying capacity of this mixture 38.6 per cent.

When cows were fed roughage alone, consisting of alfalfa hay, corn silage, and roots, with no pasture, they lost on average of 23 lbs. during the year and failed by a small margin to consume enough nutrients to meet their requirements for milk production. When a limited amount of grain was added to this ration the cows gained an average of 90 lbs. during the year and consumed on an average 2.4 per cent more nutrients than was necessary to meet their requirements. On a full grain ration the consumption of nutrients in excess of requirements averaged 29 per cent.

Holstein heifers receiving skim milk from birth to 24 months of age grew more uniformly and attained a larger size than those receiving skim milk for either 6, 12, or 18 months.

Dairy-herd-improvement associations, and stories the records tell, J. C. McDOWELL (*U. S. Dept. Agr., Farmers' Bul. 1604* (1929), pp. II+21, figs. 13).—This is a revision of and supersedes Farmers' Bulletin 1446 (E. S. R., 53, p. 676). The history, growth, and information concerning dairy-herd-improvement associations, together with some of the results of tabulations of records and analyses of these tabulations, are presented.

Milk substitutes for calves, J. B. LINDSEY and J. G. ARCHIBALD (*Massachusetts Sta. Bul. 253* (1929), pp. 113-122).—Based on the results of experiments previously noted (E. S. R., 61, p. 866) with 51 calves that had been raised on various milk products, the following method is recommended for its low feed costs and good growth produced.

Calves should be removed from dams in from 24 to 48 hours and taught to drink whole milk with a low fat content. The whole milk feeding should be continued for a week or 10 days at the rate of 6 qt. per day. At the end of this time a quart of liquid made of warm water to which is added 3.5 oz. of dried skim milk should be substituted for 1 qt. of whole milk. This substitution should be continued each day until the calves are receiving only 2 qt. of whole milk and not more than 9 qt. of liquid per day. The 2-qt. allowance of whole milk should be continued until the calf is 4 weeks old, reduced to 1 qt. from 4 to 6 weeks old, and then discontinued. Rowen and a dry grain mixture composed of ground oats, red dog flour, corn meal, and linseed meal, 30 : 30 : 25 : 15, should be before the calves at all times. At the end of 8 weeks the liquid allowance may be reduced to 6 qt. daily, at the end of 3 months at 3 qt. daily, and the calves weaned entirely from liquid feeding at the end of 4 months.

The production of high quality milk.—I, Cooling—the electric brine cooler with cold-air storage versus ice and water, H. B. ELLENBERGER (*Vermont Sta. Bul.* 300 (1929), pp. 12, fig. 1).—To compare the efficiency and economy of ice and water with an electrically-operated unit of the dry-storage type for cooling milk, records were kept of the cost of operating each, the temperature of the milk at varying times, and the average bacterial count of the milk. The studies showed that when properly used both methods were satisfactory from the standpoint of quality of milk. When ice cost \$2 per ton in the ice house there was little difference in the cost of the two methods, but with ice at \$3 per ton and electricity at 5 cts. per kilowatt-hour the mechanical method was materially cheaper.

The manufacturing process for commercial sour cream, F. J. DOAN and C. D. DAHLE (*Pennsylvania Sta. Bul.* 233 (1928), pp. 15).—A series of experiments has been conducted to determine methods of making commercial sour cream, a heavy bodied ripened cream of high acidity, clean flavor, and smooth texture, that would produce consistently good results. In practically all of the tests, samples were prepared by standardizing fresh raw sweet cream to 18 per cent fat, inoculating with 1 per cent active lactic starter, ripening at 70° F. for 15 to 20 hours, then cooling to 40°, and aging for 10 to 24 hours.

It was found that high pasteurizing temperatures were preferable to low temperatures before inoculating. Homogenizing at high pressures produced a thicker-bodied cream than low pressures, and better results were obtained if homogenization was carried out at the pasteurizing temperature. The body of the sour cream became stiffer as the percentage of fat in the cream increased. Adding extra solids in the form of condensed skim milk or skim milk powder produced a thicker body at the expense of rigidity in a homogenized cream, and sometimes impaired the flavor. Viscolizing or homogenizing after ripening and before aging gave a weaker body than processing before ripening. Adding rennet or gelatin increased the thickness of the body, but with the first product care must be taken to prevent graininess and wheying-off, while the second product is inclined to produce a gummy body. None of the methods for thickening the body could be substituted for homogenizing or viscilizing when a high-quality product was desired. It was found desirable to ripen the sour cream in bottles or jars, as this practice appears to give a stiffer body and makes the packaging process much less difficult.

Keeping quality of butter made from cream of various acidities, W. WHITE, C. S. TRIMBLE, and H. L. WILSON (*U. S. Dept. Agr., Tech. Bul.* 159 (1929), pp. 8).—To determine the maximum acidity that cream may contain without hastening the deterioration of butter, four series of churnings were made. In the first series, 10 lots of sweet cream were each divided into 5 parts, one of which was used sweet, the acidity averaging 0.15 per cent, while the other samples were standardized to 0.22, 0.25, 0.28, and 0.31 per cent acid, respectively. The cream was pasteurized after being standardized. The second series was the same as above, except that the cream was standardized after pasteurization. In the third series, 9 lots of cream were each divided into 4 parts and each part churned at 0.25 per cent acidity. One of these lots was pasteurized sweet and then cultured, the second lot was cultured before pasteurizing, the third lot was cultured to 0.35 per cent acidity, neutralized with lime to 0.25 per cent, and then pasteurized, and the fourth lot was cultured to 0.45 per cent acidity, and then handled in the same manner as the third lot. For the fourth series, 7 churnings of cream were pasteurized sweet, then cooled, and each churning divided into 4 parts. One part was held overnight and churned at an average acidity of 0.14 per cent,

while 10 per cent lactic acid culture was added to the other lots, and the lots held overnight at such temperatures as to develop 0.25, 0.31, and 0.35 per cent acid, respectively. Samples of each churning were stored in two refrigerators, one at approximately 0° F., and in the other the temperature ranged from 30 to 50°.

After 12 months' storage at 0°, butter made from cream with an acidity of 0.15 to 0.25 per cent had deteriorated less than that in the 0.28 and 0.31 per cent acid groups. The deterioration in butter held for 4 months at 30 to 50° was lower in the low-acid cream butters than in those made from the greater acidity groups. The same was true of butter stored at 0 to 20° for 8 to 11 months. Butter made from cream with an acidity of 0.31 per cent may be expected to keep well for as long as 8 months when stored at 0° or lower, but there appears to be no advantage in such a practice. While ripening cream with a lactic acid culture, even to low acidities, improves the score of butter when fresh, the improvement is lost during storage.

In commercial butter held at 0° for 5 months, deterioration was greater in the high-acid cream butters than in those made from cream with lower acidity. After storage, however, the butter in all the acidity groups up to 0.3 per cent scored about the same. The average score for the 0.31 to 0.35 per cent acid group was about 0.5 point lower, and for the 0.36 to 0.45 per cent acid group about 1 point lower than the scores for the groups of less than 0.31 per cent acid.

The keeping quality of stored dairy products (*Vermont Sta. Bul. 299 (1929)*, pp. 16).—This bulletin is divided into two parts, as follows:

I. *Metallic flavor in frozen cream*, H. B. Ellenberger and H. L. White (pp. 3-9).—The results of this study (*E. S. R.*, 56, p. 570) indicate that only cream of the best quality should be frozen and stored. The containers in which frozen cream is stored should be free from corroded or bare spots of iron or copper, and the same applies to all metal containers with which the cream intended for this purpose comes in contact. Well-tinned receptacles make suitable storing containers, but properly lacquered or granite or agate-coated cans gave best results. When properly handled high-quality cream may be frozen and stored for at least 6 months with little or no deterioration in flavor.

II. *Comparative keeping quality of cream, butter, and butter oil*, J. A. Newlander and H. B. Ellenberger (pp. 10-16).—The results of several comparisons of the keeping qualities of cream, butter, and butter oil at varying temperatures are reported. The cream was held at 0° F., while samples of the other products were held at 0, 35, 50, and 70° for periods of from 3 to 9 months. Cream of both average and high quality was used. At 0° high-quality cream was successfully stored for from 4 to 6 months. Butter did not keep well at temperatures above 0°, and while some of the butter oils remained in good condition for short periods at temperatures as high as 50°, it is not recommended that butter oil be stored above 0°. When stored at 0° for from 4 to 6 months, there was little difference in the condition of high-grade cream and its products. For average-quality cream, however, the keeping qualities of butter oil markedly surpassed that of the cream and butter.

VETERINARY MEDICINE

The fundamentals of bacteriology, C. B. MORREY (*Philadelphia: Lea & Febiger, 1929, 4 ed., rev., pp. XIII+17-347, pls. 6, figs. 175*).—This is an introductory textbook.

Pathogenic microorganisms, W. H. PARK, A. W. WILLIAMS, and C. KRUMWIEDE (*Philadelphia: Lea & Febiger, 1929, 9. ed., rev. and enl., pp. IX+17-819*,

pls. 9, figs. 216).—This is a ninth thoroughly revised and enlarged edition of the work previously noted (E. S. R., 42, p. 774).

The veterinary adviser, A. S. ALEXANDER (New York: Orange Judd Pub. Co., 1929, pp. 128, pls. 6, figs. 10).—This is a practical account.

Veterinary problems (*Montana Sta. Rpt. 1928*, pp. 39-41).—A brief discussion of several lamb diseases and bloat among cattle and sheep on sweetclover pastures.

Report of the New York State Veterinary College at Cornell University for the year 1927-1928 (*N. Y. State Vet. Col. Rpt. 1927-28*, pp. 244, figs. 35).—Among the reports of clinics and research presented in the appendix to this report (E. S. R., 60, p. 71) are the following:

Report of the Diagnostic Laboratory, July 1, 1927, to June 30, 1928, by C. M. Carpenter, D. W. Baker, and C. J. Parshall (p. 41); Studies on Undulant Fever, by C. M. Carpenter and R. A. Boak (pp. 42-52); Report of the Diagnostic Work on Poultry Diseases at Ithaca, July 1, 1927, to June 30, 1928, by E. L. Brunett (pp. 53-55); Report of the Poultry Disease Laboratory at Farmingdale, Long Island, July 1, 1927, to June 30, 1928, by J. M. Hendrickson (pp. 56-59); Diseases of the Newborn, by D. H. Udall (pp. 60-70); Health Control of Breeding Horses, by M. G. Fincher (pp. 71-83); Handling Bang Abortion Disease. A Program for the Veterinary Practitioner, by R. R. Birch and H. L. Gilman (pp. 84-90); Technique of the Agglutination Test for Bang Abortion Disease (pp. 91-95) and The Relation of the Bull to the Spread of Bang Abortion Disease (pp. 96-101), both by H. L. Gilman; A Report on the Application of a Plan for the Control of Bang Abortion Disease, by G. W. Derrick (pp. 102-149); Johne's Disease or Paratuberculosis of Cattle (pp. 150-171) and Johnin versus Avian Tuberculin as a Diagnostic Agent for Paratuberculosis (Johne's Disease) of Cattle (pp. 172-189), both by W. A. Hagan and A. Zeissig; A Post-mortem Method with the Anatomy of the Domestic Fowl, by E. Sunderville (pp. 190-206); The Normal Blood of Some Domesticated Animals, by C. E. Hayden and P. A. Fish (pp. 207-212); The Physiology of the Blood of Chickens, by C. E. Hayden (pp. 213-220); Immunizing Young Pigs against Hog Cholera. VI, by J. W. Benner (pp. 221-227); Bacillary White Diarrhea Control Project, 1926-27, by E. L. Brunett (pp. 228-238); and Physiological Examination of Dogs, by H. J. Milks (pp. 239-242).

Annual report for 1928 of the principal of the Royal Veterinary College, F. T. G. HOBDAV (*Jour. Roy. Agr. Soc. England*, 89 (1928), pp. 290-293).—Data are given on outbreaks of glanders, anthrax, foot-and-mouth disease, sheep scab, and swine fever in Great Britain.

Sixth report of the Government Institute for Veterinary Research ([Chosen] *Govt. Inst. Vet. Research Rpt.*, 6 (1929), *Eng. abs.*, pp. 1-14; *Ger. abs.*, pp. 14-18).—The contributions presented in this sixth report (E. S. R., 60, p. 72) are as follows: Experiments on the Rinderpest Vaccine, I (p. 1), II (pp. 2-12), by C. Kakizuki, S. Nakanishi, J. Nakamura, and Y. Toshijima; Studies on the Drug-Resistance of Rat-Bite Fever Spirochete, *Spirochaeta morsus muris*—I, Bismuth-Resistance, by S. Akazawa and K. Kasai (pp. 13, 14); On the Effects of Polished Rice Feeding and Its Vitamin B Defect in the Horse, III, by K. Naito, T. Shimamura, and K. Kuwabara (p. 15); On a New Infectious Disease of Fowls in Korea, by Y. Ochi and K. Hashimoto (p. 16); and On the Complement Fixation Reaction to Rinderpest Conditioned by Active Antiserum. I, by J. Nakamura (pp. 17, 18).

Pathogenic anaerobic bacillus not hitherto described cultured from fatal operative wound infection, F. L. MELENEY, F. B. HUMPHREYS, and L. CARP (*Soc. Expt. Biol. and Med. Proc.*, 24 (1927), No. 7, pp. 675-677).—Under the

name *Clostridium oedematoides* n. sp. the authors describe an anaerobic organism which they cultured from the lesion in a fatal human operative wound infection and from catgut in New York. The organism was found to be pathogenic in small doses for eight different species of laboratory animals. It produces a lesion in these animals somewhat resembling the lesions produced by *Bacillus oedematiens* and *Vibrion septique*, but differs from them strikingly in certain of its cultural characteristics. Serologically it has been demonstrated to be distinct from both of these organisms.

Comparative study of *Bacillus sordellii* (Hall and Scott) and *Clostridium oedematoides* (Meleney, Humphreys and Carp), I. C. HALL, M. R. RYMER, and E. JUNGHERS (*Jour. Infect. Diseases*, 45 (1929), No. 1, pp. 42-60, figs. 2).—This is a contribution from the Montana Experiment Station and the University of Colorado School of Medicine cooperating.

The authors conclude that the organism received by Hall from A. Sordelli in Buenos Aires, Argentina, where he had isolated it from 2 of 11 cases of gaseous gangrene in man and which was named *B. sordellii* by Hall and J. P. Scott in 1927,⁴ is identical in all essential morphologic and cultural characteristics and in all its toxin-antitoxin reactions with *C. oedematoides* described by Meleney, Humphreys, and Carp the same year from a fatal operative wound infection and from catgut in New York, as above noted.

The occurrence of *Bacillus sordellii* in icterohemoglobinuria of cattle in Nevada, I. C. HALL (*Jour. Infect. Diseases*, 45 (1929), No. 2, pp. 156-162).—The author has found that two strains of a previously unidentified anaerobe, isolated in 1919 and 1921 by Vawter at the Nevada Experiment Station from typical cases of icterohemoglobinuria in cattle and against which he and Records prepared an effective antitoxic serum (*E. S. R.*, 56, p. 278), represent the species *B. sordellii*, described by Hall and Scott in 1927, which is identical with *Clostridium oedematoides* as above noted. Although the third locality in the world in which the organism has been recognized, this is said to be the first time from cattle. The Nevada strains of *B. sordellii* are regarded as probably secondary invaders in icterohemoglobinuria, the primary cause of which is believed to be the *C. hemolyticus bovis* described by Vawter and Records in 1926 (*E. S. R.*, 54, p. 677).

C. hemolyticus bovis resembles *B. sordellii* in its vegetative morphology and Gram-staining reaction, its sluggish motility, its fermentation reactions with the exception of maltose, and its action on gelatin. It differs from *B. sordellii* in its sparse production of spores by old cultures, its weaker proteolytic action, its failure to ferment maltose, its hemolytic action on blood in culture medium, its marked tendency to produce congestion in animals, and the specific antigenicity of its soluble toxin.

***Alcaligenes abortus* from the spinal fluid, F. W. SHAW (*Science*, 70 (1929), No. 1819, p. 454).—**The author reports having isolated the porcine variety of the infectious abortion organism from the spinal fluid in a case of suspected infantile paralysis occurring in a child 2½ years of age at Richmond, Va.

Investigations of the rôle of *Brucella abortus* as an organism pathogenic to man [trans. title], M. KRISTENSEN (*Centbl. Bakt. [etc.]*, 1. Abt., Orig., 108 (1928), No. 1-4, pp. 89-102, figs. 6; abs. in *Bul. Hyg.*, 4 (1929), No. 2, pp. 111, 112).—The author's observations indicate that human infections of *B. abortus* are of relatively frequent occurrence. Of 1,375 samples of blood taken between April 1 and November 15, 1927, from 1,177 patients tested at the State Serum Institute at Copenhagen for the presence of typhoid agglutinins the sera of 89 agglutinated *B. abortus* at a dilution of 1 : 100 or more. Comple-

⁴*Jour. Infect. Diseases*, 41 (1927), No. 5, pp. 329-335.

ment fixation tests were then made, and the results obtained were in close agreement. It was found that 34 of the 89 patients had been in direct contact with infected cattle. In 39 cases there was a possibility of infection through milk or cream. In the remaining 16 cases the mode of infection remained obscure.

Absorption of agglutinins by "R" variants of bovine and porcine strains of *Brucella abortus*. B. S. HENRY (*Soc. Expt. Biol. and Med. Proc.*, 27 (1929), No. 1, pp. 8-10).—The author obtained "R" variants of seven strains of bovine source, eight strains of porcine source, and one strain from a spontaneously infected laboratory guinea pig by growing the cultures in broth plus 10 per cent anti-*B. abortus* rabbit serum. Cells for absorption were obtained by growing the several cultures on 1 per cent glucose-2 per cent glycerine agar in sealed Blake bottles. The absorption was accomplished by the addition to antiserum of the same quantity of the various antigen suspensions which had been standardized to 1.5 mm. on the Gates opacimeter.

The "R" variants of bovine source with one exception removed the *B. abortus* agglutinins, while similar quantities of the "R" variant of porcine strains showed a much smaller absorbing capacity. Of the seven bovine strains tested, five showed relatively large absorbing capacity; one absorbed to a lesser degree than the other bovine strains, but more completely than did any of the porcine. One gave results similar to the porcine strains. This culture, although of bovine origin, has other characteristics of a porcine strain. Of the strains of porcine source, six showed slight absorbing power, one was only slightly less active than one bovine strain, and one gave a reaction similar to the bovine group.

Note on the treatment of an infection with *B. abortus* in rabbits. C. I. B. VOGE (*Jour. Compar. Path. and Ther.*, 42 (1929), No. 3, pp. 205-207).—In studies conducted in the animal breeding department of the University of Edinburgh it was found that serum euglobulin obtained from antiabortus cow serum was capable of affording protection to a rabbit subsequently infected with *Brucella abortus*. Serum euglobulin from normal serum did not act in like manner, although the effects of such an infection appeared to be less drastic than where no treatment at all was administered.

Undulant fever. F. J. HIRSCHBOECK (*Minn. Med.*, 12 (1929), No. 10, pp. 590-598, fig. 1).—This discussion is presented in connection with a list of 22 references to the literature.

The relationship between undulant fever and epizootic abortion (*Jour. Compar. Path. and Ther.*, 42 (1929), No. 3, pp. 208-211).—This is a brief summary of the present state of the knowledge of the subject.

[**Infectious abortion and sterility studies at the Kentucky Station**] (*Kentucky Sta. Rpt.* 1928, pt. 1, pp. 18-20).—In agglutination tests made of several herds the blood of a few cows reacted positively to *Brucella melitensis*, as did seven samples of the blood from persons affected with a fever. Three samples of human blood also reacted positively to *B. abortus* infection. A bacterin made from *Bacillus abortivo-equinus* was administered to 2,681 mares on 88 farms, and so far as could be determined not a single abortion occurred. Thirty-seven fetuses from mares were cultured, a streptococcus being isolated from 8 and *B. abortivo-equinus* from 8, the others being negative to both of these organisms. It is pointed out that dams of the fetuses from which the *B. abortivo-equinus* was isolated had not been vaccinated against that organism. A number of fetuses from aborting sows were cultured during the year, *B. abortus suis* being isolated from the internal organs from pigs of four of these sows. Bacteriological examinations made of 147 fetuses from

mares resulted in finding 78 (53 per cent) to be positive, of which 57 showed streptococci, 10 *B. abortivo-equinus*, 2 *B. viscosum equi*, and 9 miscellaneous.

Examinations made of 2,350 barren mares showed that 822 were suffering with infection of the genital tract and that cervicitis and metritis were apparently the causes of their failure to reproduce. Of these 822 mares, 540 were infected with *Streptococcus genitalium*; 94 with *Encapsulatus genitalium*; and 182 were classed as miscellaneous types of infection.

Bibliography on bovine infectious abortion for 1927, W. GILTNER (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 2, pp. 232-238).—This is a list of the literature on bovine infectious abortion in continuation of the author's bibliography issued annually since 1917.

The collection of blood samples for the agglutination test in bovine infectious abortion, R. L. HECTORNE and R. GRAHAM (*Illinois Sta. Circ.* 348 (1929), pp. 8, figs. 9).—This is an illustrated account of the method of collecting blood.

The breeding efficiency of a herd of cows negative to the agglutination test for abortion, H. LOTHE (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 2, pp. 148-172, figs. 3).—A paper presented at the annual meeting of the American Veterinary Medical Association at Minneapolis, Minn., in August, 1928.

Report of experimental work in the control of bovine infectious abortion, C. P. FITCH, W. L. BOYD, and A. L. DELEZ (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 2, pp. 215-229, figs. 4).—This is a report of work conducted at the Minnesota Experiment Station extending over a period of five years, which confirms the earlier conclusion drawn from work of the first two years (E. S. R., 57, p. 279) that the organism does not spread rapidly among two groups of animals kept entirely separated. The two herds, one infected and one free, were kept in two barns separated not more than 75 ft. and attended by the same men. The authors believe that the pasture and paddock offer more opportunities for the disease to spread than the barn and stanchion.

The relation of the bull to the spread of Bang abortion disease, H. L. GILMAN (*Cornell Vet.*, 18 (1928), No. 2, pp. 159-166).—This is a discussion of the subject presented in connection with a list of 26 references to the literature.

The 1929 outbreak of foot-and-mouth disease in California, J. R. MOELLER (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 3, pp. 309-318).—This is a brief account of the outbreak which occurred in California in January, 1929, and was eradicated within two months following its discovery.

The resistance of the nymphal tick (*Boophilus australis*) to the action of arsenical dipping fluids, J. LEGG (*Aust. Vet. Jour.*, 5 (1929), No. 3, pp. 114-116).—It is concluded that the tick is destroyed by the absorption of arsenic through its own integument.

The mercuric chloride test for trypanosomiasis in camels: Mechanism of the reaction, E. S. HORGAN and S. C. J. BENNETT (*Jour. Compar. Path. and Ther.*, 42 (1929), No. 3, pp. 188-196).—The earlier observations on the delicacy of the mercuric chloride test (E. S. R., 60, p. 869) are confirmed in the work here reported. Positive reactions are referable to the relative and absolute increase of the euglobulin of the serum.

Tularemia: History, pathology, diagnosis, and treatment, W. M. SIMPSON (*New York: Paul B. Hoeber*, 1929, pp. XIX+162, pls. 2, figs. 53).—The several chapters of this work following the introduction deal with the history and zoological distribution, tularemia among laboratory workers, clinical manifestations of tularemia in man, pathology in man, bacteriology, serology, diagnosis, treatment, and unique features of tularemia, respectively. A bibliography of 12 pages is included.

Tularemia: Its transmission to sheep by the wood tick, *Dermacentor andersoni* Stiles, R. R. PARKER and J. DADE (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 2, pp. 173-191).—This is a detailed report of investigations conducted in Idaho and Montana, an earlier account of which has been noted (E. S. R., 60, p. 872).

***Aspergillus fumigatus* infection of the kidney, M. W. EMMEL** (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 3, p. 369).—In this contribution from the Michigan Experiment Station the author reports observations of an *A. fumigatus* infection of an 8-weeks-old chick. The anterior two-thirds of the right kidney was covered with a greenish brown growth of this fungus parasite. It has been observed to produce areas of necrosis in the kidney and other visceral organs when injected intravenously or intraperitoneally.

Hippuric acid elimination in the urine of cattle, E. A. HEWITT (*Cornell Vet.*, 19 (1929), No. 3, pp. 318-326).—Ninety was the average normal percentage of combined benzoic acid eliminated in the urine of cattle as shown by repeated trials on three different animals. The highest percentage was 99.58, and the lowest was 57.45. It is pointed out that, with such a range of variation in the normal elimination and because of the character of the diet of cattle, it is not possible to use the rate of elimination of hippuric acid as an index to kidney impairment.

The significance of utero-chorionic lesions in the cow, W. L. WILLIAMS (*Cornell Vet.*, 19 (1929), No. 3, pp. 254-272, pls. 12).—This account is presented in connection with a list of 15 references to the literature.

Sugar, guanidine, and cholesterol in the blood of the cow in milk fever, C. E. HAYDEN (*Cornell Vet.*, 19 (1929), No. 3, pp. 285-295).—This account is presented in connection with a list of 18 references to the literature.

Immunization of cattle against bacillary hemoglobinuria, L. R. VAWTER and E. RECORDS (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 2, pp. 201-214).—This is a summary of work conducted at the Nevada Experiment Station during the years 1926, 1927, and 1928, in which many thousand head of cattle were immunized by the administration of 5-cc. doses of phenol-killed bacterin of the causative organism, *Clostridium hemolyticum bovis*, described in 1926 (E. S. R., 54, p. 677). The administration of 5-cc. doses of living nontoxic cultures of *C. hemolyticum bovis* plus 25 per cent glycerin under experimental conditions in 1928 gave complete protection for eight months with no bad effect.

In continuing their studies of the disease (E. S. R., 62, p. 76), the authors have confirmed the earlier findings that this is the causative organism of bacillary hemoglobinuria and have demonstrated its antigenic properties. A method of preparing whole-culture bacterins and glycerinated nontoxic live-culture vaccines with it is described. The glycerinated nontoxic culture vaccine appears to confer a more solid and lasting immunity.

The name bacillary hemoglobinuria is adopted to replace icterohemoglobinuria formerly used, it having been found that the latter name had been applied to a disease of sheep with a different etiology.

Conference on cattle diseases (Newport, Salop, Eng.: Harper Adams Agr. Col., 1929, pp. 24).—This is a report of a conference held at the Harper Adams Agricultural College in April, 1929, on contagious abortion, tuberculosis, and mastitis (garget), summaries of addresses on which by W. A. Pool, S. H. Gaiger, and F. C. Minett, respectively, are included.

Blackquarter in Nigeria, F. H. MANLEY (*Jour. Compar. Path. and Ther.*, 42 (1929), No. 3, pp. 196-205).—The author reports that blackleg in Nigeria attacks animals of all ages with equal facility. One per cent of phenol does not inhibit the growth of *Clostridium chauvei* in culture. Some native sheep appear to

offer resistance to artificial infection with local strains of blackleg. Culture sterilized with 0.4 per cent formalin and inoculated subcutaneously completely protects bovines against subsequent intramuscular inoculation with virulent culture. The preparation of this formolized culture is described.

Meningoencephalomyelitis of swine, L. P. DOYLE (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 3, pp. 342-346, figs. 3).—This is a contribution from the Indiana Experiment Station in which the author reports having observed a well-marked inflammation of the cerebral and spinal meninges, the encaphalon, and the spinal cord of pigs in nine instances in which the affected animals showed marked nervous symptoms. In one outbreak there was a death loss of about 65 per cent. The essential histopathologic change was a round cell, mainly perivascular, infiltration of the central nervous system. A pig which had not shown any symptoms except posterior paralysis was found to have similar infiltrations in the white matter of the spinal cord.

"Bacterium paraviscosum equi," F. A. TURANDIN (*Ztchr. Infektionkrank. u. Hyg. Haustiere*, 33 (1928), No. 4, pp. 266-281, figs. 2).—Under the name *B. paraviscosum equi* the author describes an organism isolated from the purulent discharge of the lesion of epizootic lymphangitis in a horse. It is clearly differentiated biochemically from *B. viscosum equi*.

Studies in dog distemper.—V, The immunisation of dogs, P. P. LAIDLAW and G. W. DUNKIN (*Jour. Compar. Path. and Ther.*, 41 (1928), No. 3, pp. 209-227).—In this fifth contribution (E. S. R., 59, p. 676), the authors report having found dog distemper vaccines made from distemper ferret spleens by treatment with formaldehyde to be efficient antigens for dogs if multiple injections be given. "Dog distemper vaccines made from distemper dog tissue by formolization may be efficient antigens when a single dose is given. The evidence indicates that the efficiency, or otherwise, of a homologous vaccine is dependent on the virus content of the tissue from which it is made. A dog which has been treated with dead vaccine alone shows resistance to distemper virus, but is not completely immune. A vaccinated dog which has subsequently received living virus becomes immune. The immunity so produced is solid, long lasting, and firm against other strains of distemper virus.

"The results of the laboratory experiments are applicable, with limitations, to field work, but it is too early to assess the value of the results of the larger scale investigation. Dog distemper vaccines made from distemper dog tissue are of small value for ferrets even when multiple injections are given. The central nervous system partakes in the general resistance of the immune animal. The immunity of the recovered dog is probably cellular in origin, though there is some evidence that the hyperimmune animal may have protective substances in the circulating fluids."

A report upon the cause and prevention of dog distemper, P. P. LAIDLAW and G. W. DUNKIN (*Vet. Jour.*, 84 (1928), No. 642, pp. 600-637, figs. 8; also in *Indian Vet. Jour.*, 6 (1929), Nos. 1, pp. 30-47; 2, pp. 96-115).—This account, based upon studies above noted, is presented in connection with a list of 40 references to the literature.

A study of the parasites of the digestive tract of thirty-five dogs, C. R. SHAW (*Kans. Univ. Sci. Bul.* 18 (1928), No. 9, pp. 491-498).—In the examination of 35 dogs made at Kansas University 83 per cent were infested with tapeworms, including species of *Dipylidium*, *Taenia*, and *Multiceps*. Of the dogs examined 83 per cent were infested with *Ankylostoma canina*; 51 per cent were infested with both tapeworms and hookworms, but all dogs infested with tapeworms did not have hookworms or other parasitic infestation. Five per cent of this group of dogs were infested with *Belascaris marginata*, 4 per

cent with whipworms representing *Trichuris depressiusculus*, and 8.5 per cent harbored no parasites in the digestive tract. It is pointed out that few sheep are raised in this territory, thus few tapeworms of the species *M. multiceps* and *T. hydatigena* were found.

The diseases of fowls, with particular consideration of anatomy and hygiene, W. ORTE (*Die Krankheiten des Geflügels mit besonderer Berücksichtigung der Anatomie und der Hygiene*. Berlin: Richard Schoetz, 1923, 2. ed., pp. VII+422, figs. 163).—The first part of this work deals with anatomy (pp. 1-82), the second part with hygiene (pp. 83-127), and the third part with diseases (pp. 128-408).

Poultry diseases, including diseases of other domesticated birds, with chapters on the anatomy and physiology of the fowl, B. F. KAUFF (*Chicago: Alexander Eger, 1929, 5. ed., rev. and enl., pp. 436, figs. 166*).—This is a fifth revised and enlarged edition of the work previously noted (E. S. R., 57, p. 280).

[Poultry disease work at the Kentucky Station] (*Kentucky Sta. Rpt. 1928, pt. 1, pp. 28, 29*).—In a study made of the agglutination test for the detection of pullorum disease, a flock of 100 hens was tested at 30-day intervals until 12 tests had been completed. All of the hens were definitely positive reactors when placed on the test, and the majority of them gave consistent, clear-cut positive tests each month. Marked variations in the titer of the sera of several hens were observed, although none ever gave a negative reaction. In post-mortem examinations made of all positive birds in the flock that died or that were killed at the completion of the 12 monthly tests all showed visible lesions of the affection, and *Salmonella pullorum* was isolated from every case. The mortality in the flock of hens is said to have been 30 per cent. Egg production was very low, some hens not laying an egg during the 12 months of the test. Sera from 25 birds, all reactors, were sent to eight laboratories where they were tested for the disease, the agreement in the comparative tests having been 96.1 per cent, as previously noted by Edwards and Hull (E. S. R., 60, p. 374.)

Reference is made to the occurrence of lameness in pullets and cockerels. Post-mortem examinations of 60 cases originating from one flock were inconclusive.

Coccidiosis in gallinaceous birds, E. E. TYZZER (*Amer. Jour. Hyg., 10 (1929), No. 2, pp. 269-383, pls. 9, figs. 2*).—This subject is dealt with under the specific headings of the Coccidia of the chicken, including *Eimeria tenella* Railliet & Lucet, *E. mitis* n. sp., *E. acervulina* n. sp., *E. maxima* n. sp., and *Cryptosporidium parvum* Tyzzer; the Coccidia of the pheasant, turkey, and quail, including *E. phasiani* n. sp., *E. dispersa* n. sp., *E. meleagridis* Tyzzer, and *E. meleagritum* n. sp.; an experimental study of the host limitation of certain species of *Eimeria* found in the chicken, the pheasant, the turkey, and the quail, by Tyzzer and E. E. Jones (pp. 324-339); factors of primary importance in *Eimeria* infections in poultry and game birds; resistance and immunity; the eimerian nucleus and nuclear division in the schizonts of *E. tenella*; general discussion; and diagnosis and control measures. A bibliography of 50 titles is included.

The studies led to the conclusion that multiple species of *Eimeria* may be harbored by a single host species as exemplified by the chicken. "From their possession of characters that do not intergrade, it seems to the writer preferable to regard as species the different types of *Eimeria* found in the chicken and other gallinaceous birds rather than to consider them as subspecies or strains. Organisms of similar morphology, but one being more adapted to the pheasant and the other to the quail, are provisionally regarded as biological varieties of a single species. A review of earlier papers indicates that *E. avium*

is not a valid species, and that the name *E. tenella* Railliet and Lucet, 1891, applies to the pathogenic species causing disease in the ceca of the chicken. . . .

"Three new species are described from the chicken, *E. mitis*, *E. acervulina*, and *E. maxima*. The chicken also occasionally harbors a coccidium of the genus *Cryptosporidium*, which is regarded as *C. parvum* found originally in the small intestine of the common mouse. Two species of *Eimeria* are found in the turkey, *E. meleagridis* with long oöcysts and *E. meleagrimitis* with broad oval oöcysts. The latter resembles quite closely *E. mitis* of the chicken and is therefore presented as a provisional species. The pheasant likewise harbors an *Eimeria* with long oöcysts, *E. phasiani*, and one with broader oöcysts, *E. dispersa*. The latter species has as its distinctive feature the absence of the globular inclusion found in the oöcysts of other species. A similar organism, considered to be a variety of *E. dispersa*, occurs in the quail.

"Cross-infection experiments, employing certain of the species of *Eimeria* here recognized to infect the chicken, the pheasant, the turkey, and the quail indicate in general a high degree of host restriction. Thus it has not been possible to obtain any development of *E. acervulina*, *E. phasiani*, *E. meleagridis*, in other than the hosts from which they were derived. While *E. dispersa*, whether derived from pheasants or quail, is less closely restricted, the infections obtained on transfer to a foreign host are comparatively light. Although chickens and turkeys showed light infection with *E. dispersa* from the quail, a second transfer in both failed to produce infection. The degree of host restriction of the various avian species of *Eimeria* may only be determined by cross-infection experiments."

A note on coccidiosis in sparrows and poultry, D. C. BOUGHTON (*Poultry Sci.*, 8 (1929), No. 4, pp. 184-188).—The author reviews the literature, and reports upon studies conducted in which the intestinal contents of nearly 100 English sparrows from the neighborhood of Minneapolis, Minn., were examined. It is pointed out that the coccidia occurring in the English sparrow belong to the genus *Isospora* and that they do not affect chickens. Smith and Smillie (*E. S. R.*, 37, p. 384) at Princeton, N. J., found 80 per cent of 54 sparrows examined to be infected by coccidia, none of which were the coccidia attacking poultry and were probably the *Isospora lacazei* (Labbé) which commonly attacks the passerine birds. Attention is called to the fact that it was found by W. T. Johnson* at the Western Washington Experiment Station that coccidia from sparrows would not infect poultry, and those from poultry would not infect sparrows. Likewise negative results were obtained from reciprocal tests with the *Isospora* of Brewer's blackbird (*Euphagus cyanocephalus*) and the chicken *Eimeria*. In the vicinity of Minneapolis and St. Paul 66 per cent of the sparrows were found to be infected with *Isospora* but none with *Eimeria*.

It is concluded that coccidiosis in poultry is caused by coccidia belonging to the genus *Eimeria*, and that this genus has never been authentically reported from small birds.

Renal coccidiosis of geese, S. H. McNUTT (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 3, pp. 365-369, figs. 2).—The author records studies of the occurrence of renal coccidiosis in fowls on a farm in northern Iowa, it being the first record from this country. The similarity of the findings with those in European literature has led to the conclusion that the causative organism is that first reported upon by A. Railliet and A. Lucet from France in 1890[†] and in 1891,[‡] named *Coccidium truncatum* n. sp. (= *Eimeria truncata* (R. and L.)).

* *Poultry Sci.*, 2 (1923), No. 5, pp. 146-163, fig. 1.

† *Compt. Rend. Soc. Biol. [Paris]*, 9, ser., 2 (1890), pp. 293, 294.

‡ *Bul. Soc. Zool. France*, 16 (1891), p. 249.

All but 13 of 100 goslings from the eggs of 3 old females on the farm in Iowa succumbed in 1926. Seventeen per cent of 90 goslings hatched in the spring of 1927 from eggs of the same 3 old females succumbed to the affection, the losses occurring at the age of from 3 weeks to 3 months. There were no recoveries and the younger the gosling the more rapidly fatal the disease. Young ducks raised with the geese were not affected, and there was no noticeable disease in any chickens on the farm.

The transmission of bacillary white diarrhea among hens, P. R. EDWARDS and F. E. HULL (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 3, pp. 333-336).—This is a report of investigations conducted at the Kentucky Experiment Station, the details of agglutination tests being presented in tabular form.

Fifteen nonreacting hens were kept for one year in a house in contact with 73 positive reactors to the agglutination test, the fowls being allowed to range over a large yard at all times. The hens were trap nested during this time in order to minimize the possibility of transmission of infection through the ingestion of eggs containing *Salmonella pullorum*. Eleven of the 15 negative hens were living at the end of the experiment, 4 having succumbed to intercurrent disease during the course of the investigation. None of the 4 hens that died gave a positive agglutination test while living, and *S. pullorum* could not be isolated from any of them upon post-mortem examination. Of the 11 hens which survived the experiment, 5 apparently became infected during the year, 1 becoming positive during the third month, 1 during the seventh month, 2 during the eight month, and 1 during the tenth month of the experiment. *S. pullorum* was recovered from the ovary of each of these hens.

The results are considered to indicate that the disease is transmitted from hen to hen by contact, thus confirming the finding of Rettger, Kirkpatrick, and Stoneburn of 1912 (*E. S. R.*, 29, p. 288), and indicating that transmission among mature hens may occur without the presence of male birds.

Atypical *B. pullorum* infection in young chicks, N. S. BARRON (*Vet. Jour.*, 85 (1929), No. 651, pp. 359-362).—The author reports upon the appearance of pullorum infection in chicks on the sixteenth day, the mortality suddenly becoming heavy and ultimately reaching a total of over 40 per cent. No evidence of diarrhea appeared. A post-mortem examination made of two of the birds is reported upon. In a later hatching from the same flock there was a heavy mortality about the tenth day. In the fourth generation in artificial culture the organism became agglutinable and was completely agglutinated up to the titer limit of the serum. A blood test was made of the 25 hens in the flock with which the work was conducted, 13 reacting positively.

It is pointed out that the outbreak was of interest as showing a subacute form of *Bacterium pullorum* infection, due, in all probability, to the strain involved being of less than the normal virulence.

***Salmonella aertrycke* infection in the canary bird,** M. W. EMMEL and H. J. STAFSETH (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 2, pp. 230, 231).—The authors report briefly upon observations made during the last year in which five outbreaks of an epizootic occurring in canary bird stores throughout the State of Michigan came to their attention. The disease was of a highly contagious character, and a large number of birds succumbed in each case before dead birds were received at the laboratory for diagnosis.

Cultures made from the heart and liver of some of the first birds sent to the laboratory yielded a pure culture of an organism which was later identified as *S. aertrycke*, having been differentiated from *S. scholtzmülleri*. The incubation period ranged from 4 to 5 days, and the course of the disease extended over a period of from 2 to 4 days. It was found that the organism can be

isolated in pure culture from the infected birds when the brilliant-green liver-agar medium perfected by Mallmann, Thorp, and Semmes (E. S. R., 60, p. 374) is used.

Arthritis in the pigeon caused by *Salmonella schottmülleri*, M. W. EMMEL (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 3, pp. 369, 370).—This contribution from the Michigan Experiment Station reports observations of three pigeons which suffered from arthritis of the left humero ulnar-radial articulation, and one of which had both wings involved. The organism, identified as *S. schottmülleri*, was obtained in practically pure culture from the thick brownish fluid removed from the swellings.

A fatal infection of chicks due to bacilli of the paratyphoid B group, P. R. EDWARDS (*Jour. Infect. Diseases*, 45 (1929), No. 3, pp. 191-195).—This is a contribution from the Kentucky Experiment Station reporting studies of an epizootic in a flock of some 2,000 baby chicks in which the mortality had reached 25 per cent before an outbreak of coccidiosis was detected. The disease first became apparent when the chicks were three days old—the symptoms noted closely resembling those of bacillary white diarrhea. Two organisms of the paratyphoid B group, *Bacterium aertrycke* and *B. anatum*, were isolated from the chicks examined, this being the first time *B. anatum* has been recorded since its original isolation from ducklings by Rettger and Scoville (E. S. R., 42, p. 779) in 1920.

Avian tuberculosis, R. N. JOHNSTONE (*Jour. Dept. Agr. Victoria*, 27 (1929), No. 7, pp. 422-425).—A general account of this disease of the fowl as applied to Victoria, where occasional outbreaks have been met with.

Duck disease studies.—I, Blood analyses in diseased birds, P. A. SHAW (*Soc. Expt. Biol. and Med. Proc.*, 27 (1929), No. 1, pp. 6, 7).—This report deals with blood chemistry studies of diseased birds from "alkali waters" in the San Joaquin Valley district in comparison with normal healthy birds. Four blood constituents, nonprotein nitrogen, uric acid, blood sugar, and chlorides, were studied on 13 normal and 15 diseased ducks of the pintail or sprig species (*Querula acuta*). The results indicate an average increase of 50 per cent in nonprotein nitrogen and an 80 per cent increase of uric acid in the diseased birds. In the chlorides, computed as sodium chloride, a barely significant average increase was noted. The range of blood sugar values was too wide to warrant comparisons. The body temperature of sick specimens averaged 3.5° F. below normal. The results on normal and diseased birds are presented in tabular form.

Two hitherto unknown nematodes of *Rangifer tarandus* and of *Cervus canadensis asiaticus* [trans. title], S. A. RAJEWSKY (*Ztschr. Infektionskrankh. u. Hyg. Haustiere*, 35 (1929), No. 1, pp. 40-52, figs. 11).—A list is given of 24 species belonging to the genus *Setaria*, 2 of which are described, namely, *S. tundra* Issaïtschikow and Rajewsky, 1928, found to be a parasite of the reindeer (*R. tarandus*), and *S. altaica* Rajewsky, 1928, a parasite of *C. canadensis asiaticus* in the Union of Socialistic Soviet Republics.

AGRICULTURAL ENGINEERING

The Federal soil erosion projects, C. E. RAMSER (*Agr. Engin.*, 10 (1929), No. 9, pp. 277-281, figs. 27).—In a contribution from the U. S. D. A. Bureau of Public Roads, the organization of and set-up for these projects are described.

Soil erosion and water conservation facts from the North Carolina experiment, F. O. BARTEL (*Agr. Engin.*, 10 (1929), No. 9, pp. 287, 288, figs. 2).—In a contribution from the U. S. D. A. Bureau of Public Roads, the progress

results of experiments on soil erosion prevention and run-off water conservation conducted for several years in North Carolina are briefly summarized.

Experiments on soil and moisture losses from plats of varying length to determine the proper spacing of terraces showed that a slight increase in both run-off and erosion occurred as the length of plat decreased, although the further the water ran over the ground the heavier was the silt burden it picked up.

In experiments on run-off and erosion from straight crops, a definite erosion period was established which includes the four months of June, July, August, and September. During this third of the year occurred almost half of the rainfall, two-thirds of the run-off, and six-sevenths of the annual erosion. An inch of soil was eroded for every 160 in. of rainfall and every 65 in. of run-off, as compared with 1,170 in. of rainfall and 220 in. of run-off during the rest of the year. From the standpoint of water conservation, it is highly important to control the run-off during September. The cotton plat lost from 40 to over 200 times as much soil and from 4 to 18 times as much water as did the grass sod. These results are taken to indicate the necessity of discontinuing the growing of crops requiring summer cultivation and the use of artificial means of control.

Experiments with winter cover crops showed that these reduced erosion about 10 per cent. There was practically no difference in this respect between soils plowed 3 and 6 in. deep.

Measurements of run-off from terraces showed that the run-off increased as the grade increased.

Soil moisture and fertility conservation, R. E. DICKSON (*Agr. Engin.*, 10 (1929), No. 9, pp. 285-287, figs. 4).—In a contribution from the Texas Experiment Station, the progress results of the studies on soil erosion prevention and run-off water conservation being conducted at the Spur Substation are briefly summarized, and the experimental equipment is described.

Over a period of three years it has been observed that definite rain peaks occur in April and June, and are followed by a dry midsummer with heavier rainfall occurring in August and September. Planting dates can be shoved forward in order to bring the crops into heavy fruiting under more favorable climatic conditions.

One-third of the total run-off during the three years occurred in August, or at a time of the year when crops were making the heaviest demand on the soil moisture. A plat with a 1 per cent slope planted to cotton lost over five times as much water during rain storms as a level plat planted to cotton.

A heavy grass sod is practically perfect in conserving water, as the vegetative litter and grass tussocks furnish an excellent obstruction to water movement. The run-off from land planted the previous year to cotton was three times as large as from land planted to milo. To the large amount of plant residue left on the surface from feed crops as compared with the relatively small amount from cotton is due in a large part the difference in water run-off. Tillage is an important factor in the infiltration of rain water, and many of the past practices have been erroneous.

Level terraces have been much more effective than terraces having a longitudinal slope in preventing run-off. There is considered to be little question that the broad base level terrace should replace all other forms of terraces in the western portion of the Cotton Belt. The impounding of water on the land where it fails has been found to be both practical and profitable.

Sheet erosion, a process of skinning off the surface, is more destructive in the aggregate than gully washing. Torrential rains, although comparatively few, are responsible for the greater amount of soil wastage.

Units of measurement and the application of irrigation water, C. C. WRIGHT (*Washington Col. Sta. Pop. Bul. 145* (1929), pp. 21, figs. 7).—This bulletin, prepared in cooperation with the U. S. D. A. Bureau of Plant Industry, gives practical information on irrigation water measurement, delivery, and application; making corrugations and distributing water; and the efficiency and economy of irrigation.

Surface water supply of the United States, 1925, VII-X, XII B, C (*U. S. Geol. Survey, Water-Supply Papers 607* (1929), pp. IV+113, fig. 1; 608, pp. VI+268, fig. 1; 609, pp. V+145, fig. 1; 610, pp. V+141, fig. 1; 613, pp. VI+271, fig. 1; 614, pp. VI+198, fig. 1).—Of the papers which here present the results of measurements of flow made on streams during the year ended September 30, 1925, No. 607, prepared in cooperation with the States of Missouri, Colorado, Kansas, and Texas, covers the lower Mississippi River Basin; No. 608, prepared in cooperation with the States of Texas and Colorado, the drainage basins of western Gulf of Mexico; No. 609, prepared in cooperation with the States of Colorado, Wyoming, Utah, California, and Arizona, the Colorado River Basin; No. 610, prepared in cooperation with the States of Utah, Nevada, California, Oregon, Idaho, and Wyoming, the Great Basin; No. 613, prepared in cooperation with the States of Idaho, Oregon, Nevada, and Washington, the Snake River Basin; and No. 614, prepared in cooperation with the States of Oregon and Washington, Pacific slope drainage basins in Oregon and the lower Columbia River Basin.

Farm drainage, L. A. JONES (*U. S. Dept. Agr., Farmers' Bul. 1606* (1929), pp. II+25, figs. 18).—Practical information is given on the surface and under-drainage of farm lands.

Public Roads, [October, 1929] (*U. S. Dept. Agr., Public Roads, 10* (1929), No. 8, pp. 137-152+[2], figs. 15).—This number of this periodical contains the current status of Federal-aid road construction as of September 30, 1929, together with the following articles: Bituminous Surface Treatment Experiments in Department of Agriculture Grounds, by J. T. Pauls and P. F. Critz (pp. 137-147); The Freyssinet Method of Concrete-Arch Construction, by A. L. Gemeny (pp. 148-150); and Accuracy of Specific Gravity and Absorption Tests of Coarse Aggregate Investigated, by D. O. Woolf (pp. 151, 152).

Influence of aluminium on mortar strength, H. W. LEAVITT, J. W. GOWEN, and L. C. JENNESS (*Natl. Acad. Sci. Proc., 15* (1929), No. 9, pp. 740-742, figs. 2).—Studies conducted at the Maine Technology Experiment Station are reported. The results indicate that aluminum in native sands affects 7-day and 28-day tensile strength in such a manner that the larger its amount the greater is the tensile strength. Aluminum does not materially affect the strength of the test cylinders in compression.

On the joint influence of iron and aluminium in native sands on mortar strength, H. W. LEAVITT, J. W. GOWEN, and L. C. JENNESS (*Natl. Acad. Sci. Proc., 15* (1929), No. 9, pp. 742, 743, fig. 1).—Studies conducted at the Maine Technology Experiment Station are reported. The results presented furnish proof of the fact that iron and aluminum jointly and separately materially influence the strength developed by mortars made from native Maine sands. It is also concluded that the chemical condition of the sand used in cement mortars materially influences the strength of these mortars when hardened. Proof is thus furnished of the chemical interaction of the sand and the cement.

Corrosiveness of soils with respect to iron and steel, H. D. HOLLEN (*Indus. and Engin. Chem., 21* (1929), No. 8, pp. 750-755, figs. 5).—The results of studies conducted at the U. S. Bureau of Standards are reported in which the corrosiveness of soils as indicated by the initial losses of buried specimens in humid areas was correlated with their acidity. A relation was found to exist between

the ability of a soil to react on iron with liberation of hydrogen and its total acidity as indicated by titration, and the results suggest that the total acidity of a soil may be an indication of its corrosive ability.

Effects of knock-suppressing and knock-inducing substances on the ignition and partial combustion of certain fuels, R. E. SCHAAD and C. E. BOORD (*Indus. and Engin. Chem.*, 21 (1929), No. 8, pp. 756-762, figs. 20).—The results of studies, conducted at Ohio State University, which were presented at the meeting of the American Chemical Society at Detroit, Michigan, in September, 1927, are reported.

Hot-wire ignition curves were determined for toluene, isoamyl acetate, and kerosene between the lower and upper limits of inflammability. The fuel-air mixtures investigated were produced by a vapor pressure method which is shown to be applicable to the continuous and reproducible preparation of such a series of mixtures. The current required by an electrically heated platinum wire for ignition of the most easily ignitable mixture of air and toluene, isoamyl acetate, or kerosene was increased by the addition to the fuel of a knock suppressor such as lead tetraethyl or selenium diethyl. On the contrary, the addition of one of the knock inducers decreased the hot-wire ignition current. The knock suppressors and inducers used had no noticeable effect on the ignition curves obtained for toluene, isoamyl acetate, and kerosene by means of direct-current break sparks.

With the fuels for which vapor pressure data either were known or could be estimated, the fuel-air mixtures most easily ignited by a hot platinum wire and by direct-current break sparks had the calculated compositions required for giving combustion to carbon monoxide and to carbon dioxide, respectively.

Introduction of approximately 1.95 per cent by volume of one of the knock suppressors into liquid toluene, isoamyl acetate, or kerosene decreased the partial combustion taking place in the fuel-air mixture in the vicinity of a platinum wire heated by a current less than that required for ignition. On the other hand, the introduction of the same volume of a knock inducer increased this partial combustion or "pre-ignition" combustion, as it is called here, because it took place at a filament current less than that necessary for ignition.

Costs and uses for electricity on South Dakota farms (*South Dakota Sta. Bul.* 259 (1929), pp. 28, figs. 13).—This bulletin contains cost figures and other records of electricity used for farm purposes, most of which were taken from the farm homes and barns of patrons of the farm electric test line at Renner, S. Dak. Other results were obtained from actual investigations conducted at the station. The farms were practically all dairy or livestock farms.

The results suggest that a farm which is planned and operated in such a way as to use a considerable amount of electricity is the one that will make electricity pay best.

Another fact emphasized is the importance and advantage of having a farm line built primarily for farm service. A single large transformer, stepping down the voltage for a group of 17 farms, helped in distributing the cost.

Test of corn planter fertilizer attachments, O. F. JENSEN (*Agr. Engin.*, 10 (1929), No. 10, pp. 323, 324).—The data from tests of light corn planter fertilizer attachments, conducted by the Joint Committee on Fertilizer Application at the University of Wisconsin, are reported in tabular form, no conclusions being drawn.

Harvesting corn with a combine, E. G. MCKIBBEN (*Agr. Engin.*, 10 (1929), No. 7, pp. 231, 232, figs. 2).—The results of a test at the Iowa Experiment Station of combining corn are briefly reported, the purpose of which was to define more clearly the problems involved.

It was found that a reel is an unsatisfactory gathering device, as it knocks off too many ears and does not force the stalks onto the header platform in a satisfactory manner. The pea vine guard type of cutter bar gave complete satisfaction. Best results were obtained with one row of concave teeth.

Apparently the results as a whole were not very satisfactory. One of the great difficulties was getting the corn into the machine. About 50 per cent of the corn was left in the field, and the feed to the cylinder of the stalks and those ears which were harvested was very irregular. In order to keep from choking the machine frequently, it was necessary to drive about 1 mile per hour and to cut only two rows.

There was considerable trouble with ears getting between the header platforms and the header draper, thus stopping the draper. This condition caused excessive wear on the chain driving the draper. There was also much time lost because of clogging in the feeder house.

Once the corn started through the machine the threshing operation was rather satisfactorily performed. The cracking of kernels was not excessive, and the kernels were practically all removed from the cobs.

There seemed to be no difficulty in separating the corn from the larger mass of shredded stalks. However, with the equipment being used in the recleaner (adjustable-lip sieve) it was impossible to separate small pieces of broken stalks and leaf ribs from the shelled corn.

The results indicate the necessity for developing a more satisfactory gathering and feeding device and a device for separating small pieces of broken stalks from the shelled corn. It also seems likely that either the moisture content of the corn must be lower at the time of harvest or special provision must be made for drying it immediately after harvest.

Harvesting sorghums by root cutting and combining, J. P. CONRAD and E. J. STEINMAN (*Agr. Engin.*, 10 (1929), No. 7, pp. 227, 228, figs. 7).—The results of experiments at the California Experiment Station on root cutting and combining of sorghums are reported.

In the root-cutting experiments a U-blade adapted to a single-row cultivator was satisfactory in cutting a single row in soft or mellow ground. However, this carriage did not have sufficient weight or strength to stand up in cutting on hard, dry ground.

Much the greatest accuracy of cutting was secured by attaching two sloping blades on the outside of the runners of a heavy sled. The sled was chained to a tractor orchard cultivator equipped with a traction lift in such a way that the blades could be pulled out of the ground at the ends of the rows. Adjustments were made also so that by manipulation of the levers practically all of the weight of the cultivator could be put upon the sled.

A general-purpose tractor having a clearance of approximately 26 in. was found convenient for cutting one or two rows of the double dwarf varieties with rows 40 in. apart, where the draft requirement exceeded that of a 2- or 4-horse team. When the ground is quite dry a speed in excess of 2 to 2.5 miles per hour may have a tendency to push clods and tip over the cut plants. For the larger power units the 3.5- and 7-ft. spacing is desirable for either short or tall varieties. The wide space, 7 ft., affords ample room for the tractor to travel, cutting the row on either side.

Types and conditions of soil affect the drawbar pull materially. Tests conducted on Yolo silt loam, where the crop was grown without irrigation, gave an average drawbar pull of 2,600 lbs. for the sled equipped with the two sloping blades. The pull varied from 2,200 to 3,000 lbs.

Tests on a few farms where root cutting was tried showed a range in drawbar pull from 350 lbs. for a U-shaped straight blade cutting one row

with a horse-drawn cultivator in a friable, fine sandy loam, to 4,500 lbs. for sloping blades cutting two rows on rather compact clay loam.

Evidently the type of soil has some relation to the depth at which cutting must be done in order that the plant shall remain upright. Where plants were cut but 5 in. deep on dry, fine sandy loam, the soil had a tendency to fall away from the roots and let some plants tip over. Many more tipped over in that part of the field where the cutting had been but 4 in. deep. By increasing the depth of cutting to 7 in. no tipping over resulted.

Development of a power dusting device for applying Paris green as an anopheline larvicide. J. A. LEPRINCE and H. A. JOHNSON (*Pub. Health Rpts. [U. S.]*, 44 (1929), No. 17, pp. 1001-1017, pls. 6, figs. 10).—A dusting machine for destroying mosquito larvae by the use of Paris green is described. This machine consists of a power generator, an electric blower, and a small dust hopper. The whole unit is set in a small boat, and the blower is operated by one man.

It has been found that the material costs for dusting are as low as 15 cts. per acre. Hydrated lime is the most satisfactory diluent tested for use with Paris green in the power blower. Fifteen per cent Paris green mixture gives the most uniform results. Moderate breeze velocities, not over 7 or 8 miles per hour, are most satisfactory, and in breezes less than 2 miles per hour the nozzle should be well elevated. In moderate breezes a 15 per cent Paris green mixture gives a lethal path at least 525 ft. wide.

Recent experiments in drying seed cotton. C. A. BENNETT (*Agr. Engin.*, 10 (1929), No. 10, pp. 309-313, figs. 15).—In a contribution from the U. S. D. A. Bureau of Public Roads, an account is given of the development of the mechanical details of drying equipment used in experiments at the Delta Laboratory at Tallulah, La.

The results clearly indicated that the time of drying or period of exposure might be anywhere from 40 seconds to 3 minutes. Other tests showed that hot-blast temperatures of from 160 to 175° F. would not endanger the germinating qualities of the seed if the exposure did not exceed 15 minutes. The volume of heated air required varies from 40 to 100 cu. ft. per pound of damp seed cotton. Upon these fundamental features of drying were based the design and erection of a full-sized drier at a cotton gin.

The first full-sized drier had 23 trays inclosed in a wooden cabinet which was baffled in such a manner as to conduct a continuous current of hot air through the loaded trays. The trays were about 5 in. deep, 16 in. wide, and 5 ft. long, each tray being bolted with 0.25-in. bolts to two endless detachable-link chains which rode upon 2 by 4 in. rails at the sides of the cabinet. Between the trays, cotton cloth hammocks or connections were attached to prevent loss of cotton or hot air.

For driving the endless-conveyor mechanism of trays, a worm and wheel reduction was used. This was driven by an engine with three-speed governor. The power of the engine was 1.5 h. p., and the lineal speed of the conveyor was such as to give an exposure within the cabinet of from 40 to 60 seconds. Equivalent exposure of a much longer period could be secured by feeding the cotton into the trays in a thinner layer.

Steam-heating elements kept the hot-blast at from 160 to 180° during the drying runs. Six of these elements were constructed with 2 by 6 in. frames measuring 3 by 4 ft. inside, each frame containing two complete coils. The net free area of this construction is 5.5 sq. ft.; the heating surface per frame is 17.4 sq. ft.; and eight complete frames are advised as a result of many experiments. Eight complete frames give a heater 16 rows of pipe in depth, and with such a heater the temperatures of the hot-blast may be adjusted up to

about 220°. After the frames are aligned in position, the installation is completed by sheathing the exterior with building paper and gypsum board to make an air-tight, insulated heater. Steam pressures for the experimental driers varied from 60 to 100 lbs. gauge, the piping being so laid out that condensation returned to the boiler by gravity without the aid of pumps or traps.

The total cost of drying a load of seed cotton to make an average bale of cotton lint was about 92 cts. The improvements in the value of the cotton due to drying varied from 0.5 ct. per pound to as high as 3 cts. per pound.

Improvements suggested for this kind of a horizontal drier are that the number of trays should be increased to at least 42 or more, and that the length of run should be accordingly increased. By making the baffle spaces of the drier roomy, and by lining them with sheet metal, the desired oven-effect may be advantageously employed along with the hot-blast.

Further developments are also described.

The farm shop, E. C. GRAHAM and C. K. SHEDD (*Kans. Engin. Expt. Sta. Bul.* 22 (1929), pp. 20, figs. 9).—Practical information is given on the planning, design, arrangement, and use of the farm shop.

Special applications of the oxyacetylene welding process to the repair of farm implement parts, J. I. BANASH (*Agr. Engin.*, 10 (1929), No. 7, pp. 233, 234, figs. 2).—Brief practical information on the subject is given.

A mechanical refrigeration study, M. P. BRUNIG (*Agr. Engin.*, 10 (1929), No. 8, p. 268, fig. 1).—The results of a study of small mechanical refrigeration at the Nebraska Experiment Station are briefly reported, indicating that ventilation of the condenser unit plays an important part in the operation of an artificial refrigerator.

Housing farm poultry, P. MOORE, C. E. LAMPMAN, F. E. MOORE, and H. BEESFORD (*Idaho Agr. Col. Ext. Bul.* 75 (1929), pp. 39, figs. 21).—Practical information on the housing of farm poultry under Idaho conditions is given, including working drawings and specifications for structures and equipment.

Laying house equipment, H. A. BITTENBENDER, W. R. WHITFIELD, W. M. VERNON, and R. L. WATKINS (*Iowa Agr. Col. Ext. Bul.* 147 (1928), pp. 11, figs. 14).—Practical information is given on the planning and construction of laying house equipment for Iowa conditions, together with working drawings and bills of material.

Smokeless combustion in domestic heating plants, V. J. AZBE (*Mech. Engin.* [New York], 51 (1929), No. 10, Sect. 1, pp. 761-764, figs. 4).—A brief discussion is given of the principles involved in smoke elimination and different methods of furnace firing, and practical suggestions are given on how to avoid smoke and dirt and secure efficient heating in the small domestic furnace.

Turn on the water, F. W. DUFFEE and J. P. SCHAEZNER (*Wis. Agr. Col. Ext. Circ.* 229 (1929), pp. 40, figs. 17).—Practical information is given on the planning and installation of farm water supply systems adapted to Wisconsin conditions.

Sewage disposal for rural homes, E. G. HASTINGS, E. R. JONES, and F. R. KING (*Wis. Agr. Col. Ext. Circ.* 232 (1929), pp. 24, figs. 12).—Practical information is given on the planning and construction of adequate sewage disposal systems for farm homes in Wisconsin. The so-called Wisconsin septic tank is made with collapsible wooden forms for the concrete.

RURAL ECONOMICS AND SOCIOLOGY

The new farm economics, H. C. TAYLOR (*Jour. Farm Econ.*, 11 (1929), No. 3, pp. 357-367).—The present and future problems in the field of farm economics are briefly discussed.

[Papers presented at the nineteenth annual meeting of the American Farm Economic Association] (*Jour. Farm Econ.*, 11 (1929), No. 3, pp. 386-456, fig. 1).—Included are the following additional papers (E. S. R., 60, p. 883) presented at the meeting in Chicago, Ill., December, 1928, previously referred to (E. S. R., 60, p. 305): Significance of Soil Type in Farm Economy, by I. G. Davis (pp. 386-401); Problems in Determining the Economic Feasibility of Forest Use, by W. N. Sparhawk (pp. 402-411); The Community as a Factor in Classifying Land for Agricultural and Forestry Utilization in the West Virginia Appalachians, by P. A. Eke (pp. 412-421); Farm or Forest in the West Virginia Appalachians? by M. Peck (pp. 422-435); Abandoned Farm Land in New York, by L. M. Vaughan (pp. 436-444); and Elements of a Co-operative Program for Determining Annual Changes in the Farm Real Estate Situation, by E. H. Wiecking (pp. 445-456).

[Papers presented at the Fourteenth International Congress of Agriculture, Bucharest, June 7, 8, and 10, 1929] (*14. Cong. Internat. Agr., Bucarest, 1929*, [Proc., prelim. issue], Sects. 1, pp. [214]; 2, pp. [256], fig. 1; 3, pp. [115]; 4 pp. [155]; 5, pp. [170], pls. 5, figs. 8; 6, pp. [120], pl. 1, figs. 37; 7, pp. [105], figs. 2; *Rap. Hors-Sect. et Commun.*, pp. [247], pls. 2, figs. 18).—The following papers in agricultural economics presented in the several sections of the Congress are included:

Sect. 1. *Agricultural political economy*.—Agrarian Reform in Rumania, by A. Nasta (pp. 30); The Necessity and Importance of Studying the Agricultural Market, by A. Schindler (pp. 17); Evolution of the Rural Problem in Rumania Before the Agrarian Reform, by N. Iorga (pp. 24); The Agrarian Reform and Its Influence in Raising the Standard of Rural Living [in Czechoslovakia], by A. Prokeš (pp. 3); A Proposed Observatoire of Rumanian Agricultural Law, by G. Bolla (pp. 6); Conditions and Results of the Land Reform in Czechoslovakia, by V. Brdlík (pp. 16); Agrarian Reform in Egypt, by G. Fahim (pp. 6); Colonization in Spain, by Viscount De Elza (pp. 28); Causes and Results of the Land Reform in Czechoslovakia, by J. Voženilek (pp. 15); The Evolution of Rumanian Agricultural Law, by E. Negruzzi (pp. 4); The Agrarian Reform and the Redistribution of Rural Property, by I. Petrik (pp. 7); The Organization of Milk Producers in Switzerland Considered from the Point of View of International Unions for Marketing Milk and Milk Products, by E. Laur (pp. 18); Legislative Measures Proposed in the United States for Effectively Taking Care of Surpluses of Agricultural Products, by A. Hobson (pp. 18); Regulation of the Movement of Agricultural Products—Its Influence on Prices, by A. P. Jacobsen (pp. 3); The Canadian Wheat Pool, by A. J. MacPhail (pp. 5); International Trade in Agricultural Products, by G. Paparozzi (pp. 4); and The organization of Agricultural Markets and Their Influence on the Prices of Products, by E. M. Brancovici (pp. 10).

Sect. 2. *Rural economics*.—Scientific Organization of Agricultural Work, by F. E. Tapernoux (pp. 74); Terminology and Fundamental Bases for International Agricultural Records, by E. Laur (pp. 13); The Science of Agricultural Organization and Scientific Organization of Agriculture, by E. Biedrzycki (pp. 17); The Organization of Agricultural Records [in Denmark], by O. H. Larsen (pp. 7); Unification of Methods of Statistical Analysis of Agricultural Records, by E. Moszczenski (pp. 15); The Establishment of Comparable Methods in Agricultural Records, by W. Ponikowski (pp. 19); The Farm Organization in Southwestern Transylvania, by I. L. Ciomac (pp. 19); The Results of Farming Organizations in Austria, by L. Strobl (pp. 5); Agrarian Policy and Agricultural Records [in Rumania], by A. E. Dorwagen (pp. 10); Problems of Agricultural Records (pp. 3) and What Should be Done to Organize Agricultural Work in Rumania (pp. 4), both by N. D. Cornățeano; The Most

Efficient Use of Labor in German Farm Operations with Regard to the Societies of Agricultural Labor, by A. Peters (pp. 9); Results of Agricultural Record Statistics in Germany, by H. L. Fensch (pp. 39); The Development of Research Methods Applicable to Agriculture, by G. Derlitzki (pp. 7); The Organization for Obtaining Agricultural Statistics in Germany, by W. von Köppen (pp. 9); and The Principles and Methods of Farm Records, by E. Lang (pp. 6).

Sect. 3. *Cooperation*.—The Problem of the Relations Between Consumers' Societies, Producers' Cooperatives, and Individual Producers in Rumania, by G. Tașcă and G. C. Popovici (pp. 24); International Relations of Agricultural Cooperation and Their Collaboration with Consumers' Cooperatives, by F. Klinger (pp. 19); The Dairy Cooperatives of the Charentes and Poitou, by P. Mercier and Dornic (pp. 8); Relations Between Cooperative Societies of Consumers and of Producers and Individual Producers [in Denmark], by A. A. Drejer (pp. 5); Credit and Agricultural Cooperation in France, by L. Tardy (pp. 21); Relations Between Consumers' and Producers' Cooperatives and Individual Producers, by L. Piaskiewicz (pp. 7); The Role of Cooperation in the Organization of Small Owners and the Increasing of Production in Rumania, by M. Șerban (pp. 11); Relations Between Producers' and Consumers' Cooperatives in Finland and Their Role as Trade Intermediaries in Agricultural Products, by E. Hynninen (pp. 4); Relation Between Consumers' and Producers' Cooperatives and Individual Producers [in Yugoslavia], by M. Schtibli (pp. 4); and Agricultural Societies [in Germany] as Agents for Progress in Agricultural Technic (pp. 5) and Agricultural Cooperatives as a Factor in the Technical Progress in Agriculture (pp. 7), both by A. Schmidt.

Sect. 4. *Viticulture*.—The Economic Necessity of Limiting Grape Plantings in Rumania, by A. Billeau (pp. 7); The Eventual Dangers of the Extension of Vineyards, by L. Roger (pp. 7); The Eventual Dangers of Excessive Development of Vineyards, by P. Vincenzo (pp. 15); Measures Proposed in Rumania to Prevent an Overproduction Crisis, by I. C. Teodoresco (pp. 11); and The Importance of Viticulture in Portugal, by A. P. Soares Franco (pp. 38).

Sect. 5. *Animal production*.—Wool Production, by G. K. Constantinesco (pp. 28); Wool and Its Production in Yugoslavia, by S. Ulmanský (pp. 9); The Breeding of Sheep in Yugoslavia and the Methods of Increasing Wool Production, by A. Ogrizek (pp. 16); Improvement of Wool Production in France and the French Colonies, by A. M. Leroy (pp. 8); The Effect of the Development of Tractors on the Production of Horses in France, by Dechambre (pp. 10); Wool Production, by J. Rostafinski (pp. 9); Coarse Wool in Portugal, by J. De Penha Garcia (pp. 9); The Crisis in the Production of Horses—The Problem from a National [Portuguese] Point of View, by J. Fladeiro (pp. 5); Wool Production in Czechoslovakia, by V. Mácha (pp. 3); The Effect of Motorization on Horse Breeding, by W. Gaterman (pp. 6); and Wool Production in Portugal, by R. d'Andrade (pp. 6).

Sect. 6. *Agricultural manufactures*.—The Crisis in Sugar Production and the Effects on Beet Culture, by V. Brdlík (pp. 71); Sugar Beets in France Before and After the War, by E. Saillard (pp. 5); The World Crisis in Sugar and Possible Remedies, by P. J. van Ginneken (pp. 8); Status and Future of the Sugar Industry, by J. Zychlinski (pp. 12); Beet Culture and Sugar Production in Austria, by E. Dollfuss (pp. 3); The Sugar Industry and Its Actual Status in Rumania, by A. Theodoroff and A. Frundlanesco (pp. 15); and Sugar Beet Culture in Germany from the Point of View of the World Production, by H. von Ludwiger (pp. 6).

Sect. 7. *Women's section*.—Living Conditions of Rural Women in Rumania—Measures Adopted for Their Betterment, by A. G. Cantacuzène (pp. 7); Living Conditions of Rural Women [in Poland] and Measures for Their

Betterment, by W. Zebrowska (pp. 2); Living Conditions of Country Women [in Belgium] and Measures for Their Betterment, by P. De Vuyst (pp. 3); The Part and Importance of Country Women in Agricultural Production [in Belgium], by A. M. De Vuyst (pp. 3); Living Conditions of Rural Women [in Poland] and Measures for Their Betterment, by S. De Jankowska (pp. 6); The Part of Women in the Country [in Denmark]—Their Cooperation in Agricultural Production—Conditions of Living—Measures for Their Betterment, by R. La C. Madsen (pp. 9); The Part of the Rural Housewife [in Czechoslovakia] from the Point of View of Rural Sociology, by A. Prokeš (pp. 3); Country Life of Women [in Italy]—The Conditions—Measures for Their Betterment, by M. D. Gasca (pp. 9); The Methods of Home Economics Education for Improving the Conditions of Life of Country Women [in Belgium], by P. De Vuyst (pp. 11); The Status of Country Women [in Austria], by L. Greil (pp. 4); The Social and Economic Contribution of the Rumanian Villagers, by M. M. Pop (pp. 7); The Education of Rural Women in Czechoslovakia, by J. Bednarikova (pp. 2); The Importance [in Germany] of Rural Economics Schools in the Professional Education of Country Women, by M. Wolff (pp. 8); The Social and Economic Importance of Country Women in Germany, by M. von Keyserlingk (pp. 4); The Rationalization of Rural Domestic Economics from the Point of View of the Betterment of the Living Conditions of Country Women [in Germany], by L. Kuessner-Gerhard (pp. 6); The Contribution of Country Women to Cooperative Agricultural Societies [in Germany], by A. Schreiber (pp. 5); Professional Training of Rural Women in Czechoslovakia, by E. Reich (pp. 8); The Status of Country Women in the Province of Minho, Portugal, by J. Saraiva (pp. 3); and The Contribution of Women in Agriculture in the Tatra Mountain Regions of Czechoslovakia, by V. Mácha (pp. 5).

Reports of out-sections and communications.—The Structure and Status of the Cooperative Movement in Rumania, by T. Axente (pp. 12); Rural Economics Instruction in Rumania, by M. G. Dobresco (pp. 11); and The Law and Cooperation [in Rumania], by C. Partheniu (pp. 22).

Meaning and significance of correlation coefficients, M. EZEKIEL (*Amer. Econ. Rev.*, 19 (1929), No. 2, pp. 246-250)—A brief statement of the principal statistical constants obtained by correlation analysis and how they may be interpreted.

[Investigations in agricultural economics at the Kentucky Station, 1928] (*Kentucky Sta. Rpt.* 1928, pt. 1, pp. 8-13).—Results of investigations not previously noted are reported on as follows:

Agricultural credit and finance.—A study of 144 farms foreclosed on by the Federal land bank and the joint-stock land banks showed that 55 per cent were bought between 1918 and 1920. Reports from 77 State and national banks showed that three-fourths of the short-term farm loans were for three to six months and that renewals were common. The average rate of interest on such loans was 6.4 per cent for the State, being 7 per cent in the western part and 6 per cent in the north-central part.

Farm organization studies.—A study of 156 representative farmers in Taylor, Greene, and Adair Counties showed the following averages, respectively, for the group, the 25 with the highest earnings, and the 25 with the lowest earnings: Net earnings \$698, \$1,550, and \$69, and return on investment 11, 18, and 2.2 per cent. On 50 Christian County farms the 12 most successful farmers had net earnings averaging \$3,883 for labor and management of the operator, as compared with —\$141 for the 12 least successful farmers.

The relationships between roads and agriculture in New York, J. L. TENNANT (*New York Cornell Sta. Bul.* 479 (1929), pp. 84, figs. 5).—One- to three-

lay counts of travel were made on 42 State highways, 11 county and town roads in Tompkins and Cortland Counties, and 57 dirt roads in 12 counties during the summer and fall of 1926 and the summer of 1927 to ascertain the percentage of travel by the following groups of vehicles: Owned outside the State, owned in other counties of New York, and owned within the county where the record was taken. The county-owned vehicles were subclassified into city, incorporated-village, unincorporated-village, open-country-not-farm, and farm, and also as owned in, and not owned in, the township where the record was taken. Supplemental tallies of travel for one or more hours were made by 37 farmers living on hard-surfaced roads, 8 on gravel roads, and 32 on dirt roads passing their farms. Tallies were also made on 9 other State highways and 1 county road and at a number of railway crossings and 2 bridges.

Replies from 174 farmers living on hard-surfaced roads, 60 on gravel roads, and 212 on dirt roads to a questionnaire sent out for the purpose of obtaining data on the influence of the type of road on agriculture are analyzed. Facts regarding the development of the State highway system were obtained from a study of the legislation and from information furnished by the State division of highways and the office of the State comptroller.

The following table shows the origin of the travel on the roads on which the one- to three-day tallies were made:

Origin of travel on different types of roads

Origin of travel	Forty-two State highways	Eleven county and town roads	Fifty-seven dirt roads	Total for 110 roads
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Outside of the State.....	11.8	5.4	2.1	11.1
Other counties of the State.....	48.3	35.6	23.0	44.9
County where tally was made:				
City.....	18.7	17.7	15.8	18.6
Farm.....	4.6	8.7	17.0	5.3
Incorporated village.....	8.2	7.0	11.9	8.3
Unincorporated village.....	3.1	9.1	7.9	3.5
Open country not farm.....	4.1	10.2	11.9	4.7
Horse.....	.7	4.6	8.8
Taxi, bus, motor cycle, auto dealer, etc.....	2.5	1.7	1.6
Miscellaneous.....	3.6

The data from the 446 farmers regarding the effect of the type of road on agriculture are presented in tables showing for the different types of roads the classification of the farms as to topography, average distance to market and to railroad shipping point, number of adults per farm and number of such adults working on farms and working elsewhere, number of vacant houses on farms, distance to rural mail routes and to mail boxes, use of trucks and of automobiles by farmers, milk production and data as to milk hauling, number of days per year hauling by trucks and by horses was interfered with, losses resulting from snow and mud on roads, and the estimated effect of the kind of road on the value of farm land. Some of the findings as regards the effect of roads on agriculture follow:

Hard-surfaced roads give a wider choice of markets and of time of selling than do dirt roads. On farms on hard-surfaced roads there are more farm workers, more persons living on farms and working elsewhere, more regular mail deliveries, mail routes are nearer, more trucks and automobiles are used, and a higher mileage for trucks and automobiles was obtained than on farms on dirt roads. Dairy farmers on hard-surfaced roads produced more milk

per farm and a larger proportion of the milk in the winter. Milk trucks maintained a more regular schedule on hard-surfaced roads. The number of days farmers on dirt roads could not haul full loads was twice as great as the number on hard-surfaced roads. Only 12 per cent of the farmers on paved roads reported losses due to snow and mud, as compared with 63 per cent on dirt roads. Hard-surfaced roads increased the value of farm land about 20 per cent. The improvement of dirt roads costing \$10,000 per mile would be feasible for lands valued at \$50 per acre or more, provided the farmers pay on the basis of use, that is, \$1,100 per mile.

The St. Lawrence navigation and power project, H. G. MOULTON, C. S. MORGAN, and A. L. LEE (*Washington, D. C.: Brookings Inst., 1929, pp. XVI+675, pls. 2, figs. 10*).—This volume of the Institute of Economics discusses the movement for a deep waterway, the navigation and power projects, depth of channel, cost of waterway, available traffic, present traffic congestion, and the relation of the waterway to railway rate control in the United States and Canada.

Of special importance to agriculture are the sections on the waterway and agricultural traffic, by E. G. Nourse (pp. 113-157), and on the relation of the waterway to Canadian railway rates and problems, by D. A. MacGibbon (pp. 191-203); and the appendix dealing with the possible use of the waterway in shipping different agricultural products (pp. 549-594).

Human factors in cotton culture, R. B. VANCE (*Chapel Hill: Univ. N. C. Press, 1929, pp. XI+346, pls. 2*).—This is a study in the social geography of the American South, in which the material is considered under the following chapter headings: Cotton and regionalism, the cotton belt—its regions and its human ecology, the evolution of the cotton system, the risks of cotton production—the weather and the weevil, the risks of the cotton market, around the year with cotton growers, the cotton system at the turn of the quarter century, how the cotton farmer lives, human elements in cotton culture, and the cotton culture complex.

A selected bibliography is included.

Condition of farmers in a white-farmer area of the cotton piedmont, 1924-1926, H. A. TURNER and L. D. HOWELL (*U. S. Dept. Agr. Circ. 78 (1929), pp. 48, figs. 2*).—"This circular gives the results of a study of the tenure status, financial progress, and standards of living of a group of white farmers in Gwinnett, a typical cotton county centrally located in a belt of counties of piedmont Georgia farmed mainly by white."

More than 300 white farmers were visited during the summer of 1925 to obtain data which are analyzed and discussed under the headings of description and economic history of the area, farm and tenure organization and management, tenure and financial history of operators, and domestic conditions in relation to tenure.

Economic aspects of the sheep industry, E. C. VOORHIES and W. E. SCHNEIDER (*California Sta. Bul. 473 (1929), pp. 173, figs. 41*).—This bulletin analyzes the statistical data relating to the development, geographic distribution, and importance of the sheep industry in the United States; the recent trends in sheep raising; the slaughter of sheep in the United States and in California; mutton and lamb consumption; prices and purchasing power of sheep and lambs; marketing of California sheep; international trade in mutton and lamb; world, United States, and California wool production; the consumption, prices, and purchasing power of wool; international trade in wool and the imports and exports of the United States; and other phases of the sheep industry.

The study shows that since January 1, 1922, the number of sheep in the United States has increased 32.7 per cent and in California 53.9 per cent, while the increase in population in the United States has been approximately only 1.3 per cent per year. Lamb prices have not shown the recession which has usually characterized expansion of the industry in the past, and California producers have enjoyed relatively high prices during the period 1923-1929. Prices and purchasing power for slaughter sheep have been relatively lower than for slaughter lambs, and as a result the industry in most sections of the United States is on a ewe and lamb basis. During the period 1900-1928 there has been a downward trend in the per capita consumption of lamb and mutton. California lamb producers in the areas of heaviest production are able to market lambs in the Middle West and the Atlantic States at a period of the year when prices are relatively high, but considerable competition develops during certain years with fed lambs, largely from Colorado and Nebraska. The authors state that "sheepmen should be urged to put their businesses on a sound financial footing. It is probable that the purchasing power of sheep may decline during the next three or four years."

Wool prices after the slump following the war held fairly high levels until the latter part of 1928. There was a sharp decline in both domestic and foreign wool during the first six months of 1929. The authors state that a further material decline seems unlikely, but that the present outlook does not seem encouraging for further expansion in wool production at the present time.

Cost of producing crops on irrigated farms. R. T. BURDICK and H. B. PINGREY (*Colorado Sta. Bul. 353 (1929), pp. 72, figs. 24*).—This bulletin reports the results of a detailed study of irrigation farming in northern Colorado, made in cooperation with the U. S. D. A. Bureau of Agricultural Economics and covering the years 1922-1928. The results for the years 1922-1925 have been previously noted (*E. S. R., 57, p. 189*). The present report is based on 123 records.

Tables are given showing by cost items by years, 1922-1927, the cost per acre of producing potatoes, sugar beets, barley, alfalfa, oats, and wheat, of pinto beans for 1924-1927, and of seed beans for 1924-1926; the average of all records for corn, cabbage, and peas; and the cost of different crops in 1928. The cost per acre by items by years, 1922-1927, of producing potatoes and sugar beets on the farms with low and high costs per 100 lbs. and per ton, respectively, are shown, and also the yields, man, horse, and tractor hours per acre, and the average cost per acre on farms growing barley and alfalfa for four or more years and sugar beets for five years or more. Other tables show the cost per hour on each farm, 1922-1928, of man labor and horse work, and the average number of hours worked per man on each farm for the years 1922-1926.

The average cost of man labor per hour for the years covered varied from 29.92 to 34.06 cts., averaging 32.8 cts. The average hours worked per man per year varied from 2,947 to 3,302 hours, averaging about 3,000 hours. The cost per hour of horse work varied from 11.99 to 15.35 cts. for the different years, the weighted average for the period being 14.05 cts. The average returns per hour of man labor and net profit per acre for the several crops were, respectively, for potatoes 58.98 cts. and \$13.63, sugar beets 94.64 cts. and \$25.50, barley —22.12 cts. and —\$7.75, alfalfa 6.98 cts. and —\$4.22, seed beans 26.06 cts. and —\$2.07, pinto beans —29.01 cts. and —\$23.58, oats —35.51 cts. and —\$9.35, wheat 23.85 cts. and —\$1.55, cabbage 32.84 cts. and \$8.06, and peas 43.97 cts. and \$1.66.

An economic survey of Salt River Valley project in Maricopa County, Arizona (*Ariz. Agr. Col. Ext. Circ. 59 (1929), pp. 117, figs. 16*).—This survey

was made cooperatively by the U. S. D. A. Bureau of Agricultural Economics and Extension Service, the Arizona Experiment Station and Agricultural Extension Service, and several local Arizona organizations for the purpose of assembling facts pertinent to the economic status of agriculture in the Salt River Valley project. Included are the reports of the following committees: Land and water, cotton, alfalfa, commercial truck crops, citrus, dairy, poultry, beef cattle, swine, dates and grapes, deciduous fruits, and credit and finance.

Returns from different systems of farming on the Salt River Valley irrigation project. B. HUNTER and H. A. STEWART (*Ariz. Agr. Col. Ext. Circ.* 60 (1929), pp. 62).—This bulletin, prepared in cooperation with the U. S. D. A. Bureau of Agricultural Economics and Extension Service, is based on data obtained by the survey method from 175 farms in the spring of 1928, a study of dairy and crop enterprises, and the crop and livestock census reports, 1914-1928, of the project.

Standard price and production units and labor and material requirements for different crops are worked out, and with these as bases systems for 80-acre farms with different crop combinations are suggested. Tables are given for the proposed systems showing rotations, estimated yields and probable disposal of crops, labor and material requirements, and estimated receipts, expenses, and returns.

Studies in Vermont dairy farming.—V, Cabot-Marshfield area. E. W. BELL (*Vermont Sta. Bul.* 304 (1929), pp. 29, figs. 3).—This bulletin is the fifth of the series previously noted (*E. S. R.*, 60, p. 483) and reports further study of the data secured in the survey noted in the previous bulletin, with a view of determining the effect of farm organization practices on labor incomes.

The utilization of land and the maintenance of soil fertility in the area are described. Tables are given for the year studied summarizing the costs and returns in the hog, dairy calf, older dairy young cattle, and veal calf enterprises on the farms; the average cost of keeping a work animal; the average capital investment; receipts, expenses, and labor income; relation of total receipts and size of business to labor income; and the relation of number of productive livestock and productive man work units per farm, work units per man, and production of butterfat per cow to labor income.

A multiple correlation analysis of the factors total work units per farm, butterfat per cow, yield of hay per acre, man work units per man, percentage of receipts from sources other than livestock, and ratio of June to November butterfat production with labor income gave $R=0.76$. The relative significance of the six factors were 11.2, 14.6, 1.2, 21.3, 8.3, and 0.9 per cent, respectively. A table and charts show data as to the seasonal variations in the percentage of cows in milk and freshening and in production of milk on all farms, on the 22 farms having the most even production, and on the 44 farms having the most uneven production. The author draws the following conclusions:

The returns from feeding skim milk to hogs, dairy calves, or veal calves depend primarily on the prices of pork, dairy cows, or veal, but may be expected to average slightly less than 25 cts. per 100 lbs. fed. Adequate returns to the operators are not to be expected unless total receipts average over \$3,500. Such total receipts are rarely possible with a dairy of less than 30 cows unless some good cash crop or crops are grown. Total receipts per farm and efficiency in the use of man labor, followed by high average production per cow, were the chief factors affecting farm profits. As a class the farmers who produced a relatively even flow of milk throughout the year owned the highest producing cows, made milk or butterfat at the lowest cost, received the best prices, and made the highest labor income.

Agricultural survey of Europe: Switzerland, A. HOBSON (*U. S. Dept. Agr., Tech. Bul. 101* (1929), pp. 64, figs. 10).—This is the fifth bulletin of the series previously noted (*E. S. R.*, 59, p. 285). It describes the general characteristics of the agricultural population and labor, size of farms, tenure, and inheritance; the utilization of land; farm receipts and expenses; agricultural imports and exports; the dairy industry; and the legislation for, and different types of, agricultural cooperative associations in Switzerland.

Agricultural survey of Europe: The Danube Basin—Part 2, Rumania, Bulgaria, and Yugoslavia, L. G. MICHAEL (*U. S. Dept. Agr., Tech. Bul. 126* (1929), pp. 186, figs. 4).—This bulletin continues the series noted above and is part 2 of the survey previously noted (*E. S. R.*, 51, p. 490). It describes for each of the countries the utilization of land, population, land tenure, land reform, cooperation, the production of principal crops and livestock, and other economic and social phases of the agricultural situation. The possible and probable competition of each country with the United States in supplying agricultural products, especially wheat, corn, rye, barley, oats, and hogs and other animals and animal products are discussed.

[**Report of the Land Division of the Great Britain Ministry of Agriculture and Fisheries, 1927**], H. L. FRENCH ([*Gt. Brit.*] *Min. Agr. and Fisheries, Land Div. Rpt. 1927*, pp. 97).—This annual report covers the proceedings under the acts previously noted (*E. S. R.*, 59, p. 382), the Universities and College Estates Act, 1925; the Glebe Lands Act, 1888; and the Agricultural Holdings Act, 1923; and the miscellaneous activities of the board.

The Mexican agrarian revolution, F. TANNENBAUM (*New York: Macmillan Co.*, 1929, pp. XVI+543, pl. 1, figs. 17).—This publication of the Institute of Economics of the Brookings Institution describes the historical development and prerevolutionary conditions and practices of the Mexican land policy, and discusses the constitutional changes, land grants to villages, agrarian legislation, foreign landholdings in Mexico, and other effects of the revolution, 1910-1928, on landholdings and rural conditions.

Outline of Colorado tax laws for farmers and ranchmen, G. S. KLEMMERSON and C. C. GENTY (*Colorado Sta. Bul. 355* (1929), pp. 17).—Information is given regarding the levying and collection of taxes, assessment of property, sale of real estate delinquent for taxes and its redemption, motor vehicle and gasoline taxation, and the inheritance tax.

Twelfth annual report of the Federal Farm Loan Board, year ended December 31, 1928, A. W. MELLON ET AL. (*U. S. House Represent.*, 70. Cong., 2. Sess., Doc. 382 (1929), pp. III+149).—This is the report to Congress for the year ended December 31, 1928, on the operations of the Federal land banks, joint stock land banks, and Federal intermediate credit banks.

The farmers' response to price, L. H. BEAN (*Jour. Farm Econ.*, 11 (1929), No. 3, pp. 368-385, figs. 6).—Using a simplified method of graphic curvilinear correlation, a study is made of the relation between prices received by producers during the first and second season preceding the change in acreage and the absolute increase or decrease over the preceding year in the acreage harvested and between hog production and corn-hog ratios in the two preceding years. The products considered are potatoes in New York, Michigan, and Idaho; flax in North Dakota; and potatoes, sweetpotatoes, cabbage, strawberries, watermelons, rye, cotton, and number of hogs on farms in the United States. The period covered is 1921-1928. The method of analysis is illustrated for potatoes in New York and hogs in the United States.

The investigations showed the following: (1) A general type of production response to price. (2) In each case the price received for the production of the preceding season was the dominant factor in the change in production in a

given year. In most cases the price received during the season two years preceding was an important factor, particularly if the price had been low, but the response for several of the commodities did not follow a general type. (3) Although there is a general similarity in the response to the price one year preceding, the extent of the response and the responses to high and low prices differ for different commodities and for different regions. (4) Each commodity under ordinary conditions has a definite average national price which tends to maintain acreage unchanged. For each commodity also there are different regional prices that tend to maintain constant acreages in the different areas. (5) In the case of competing crops, equilibrium prices tend to vary with the prices of the competing commodities. Prices only 10 per cent above or below the equilibrium price tend to be followed by about the same percentage increase or decrease in acreage. Very high prices bring forth no materially greater change than do moderately high prices. (6) The effect of high prices lasts only one season in some cases and at least two in others. Low prices in most cases affect at least two seasons. (7) Numbers of hogs on farms show the same type of responses to antecedent prices as do crop acreages.

Marketing: A farmer's problem, B. F. GOLDSTEIN (*New York: Macmillan Co., 1928, pp. XIV+330*).—This book traces the development of grain marketing facilities at Chicago from 1848 to 1928. Special attention is given to the legislative and court decisions bearing on the Chicago Board of Trade, public and private warehouses, and railroads as carriers of grain. A carefully compiled bibliography of periodical articles, Chicago Board of Trade documents, United States and Illinois official publications, newspaper and trade journal articles and treatises, and lists of statutes and cases cited are included.

American produce markets, H. E. ERDMAN (*Boston and London: D. C. Heath & Co., 1928, pp. XIII+449, figs. 25*).—This text describes the development of produce marketing and the marketing machinery and its operations and explains the economic services performed by the machinery.

Analysis of proposed change in staple length—basis of cotton futures contract, A. W. PALMER (*Textile World, 75 (1929), No. 5, pp. 167-171, figs. 3; also in Internatl. Cotton Bul., 7 (1929), No. 27, pp. 441, 442, 445-448, 451, 452*).—The possible effects of changing the staple basis of futures contracts from $\frac{7}{8}$ to 1 in. or longer are discussed. The author suggests a $\frac{15}{16}$ -in. basis with a premium for 1-in. cotton and a discount for $\frac{7}{8}$ -in. cotton.

Milk receiving station operation in Vermont, O. M. CAMBURN (*Vermont Sta. Bul. 303 (1929), pp. 39*).—The results of a study of the cost and efficiency of handling milk at 13 plants during a year are presented. The study was limited to the operations and processes within the stations. The plants were divided into three groups according to their annual receipts of milk as follows: Class A, less than 5,000,000 lbs.; class B, 5,000,000 to 10,000,000 lbs.; and class C, 10,000,000 lbs. and over. Each station was visited at least once a month to obtain a detailed record of time spent on different operations. Tables are given and discussed showing for the different classes of stations the average valuation of land and buildings and of equipment; the costs, by items and distributed to operations; and the amount of labor required for different operations.

The average costs per 100 lbs. of milk handled were for class A 29.07 cts., class B 20.65 cts., class C 18.7 cts., and all plants 22.64 cts. The average wages at the 13 stations were distributed as follows: Receiving room 24.87 per cent, handling room 34.58 per cent, and supporting work 40.55 per cent. The average annual land and building costs and equipment costs were allocated, respectively, as follows: Receiving room 11.68 and 20.85 per cent, handling room 58.86 and 28.3 per cent, and supporting work 29.46 and 50.85 per cent.

Grading and marking of English wheat flour (*Jour. Min. Agr. [Gt. Brit.], 36 (1929), No. 6, pp. 513-517*).—The regulations regarding grade designations and definitions prescribed by the Agricultural Produce (Grading and Marking) (Wheat Flour) Regulations, 1929, the national mark prescribed by the Agricultural Produce (Grading and Marking) (General) Regulations, 1928, and the conditions of enrollment as a registered packer are given.

The export debenture plan for wheat, J. S. DAVIS (*Wheat Studies, Food Research Inst. [Stanford Univ.], 5 (1929), No. 8, pp. [1]+301-346*).—The plan and the theory of the export debenture plan as it relates to wheat and flour, the experience of foreign countries with such a plan, the probable effect of the plan on farm prices and production, and the probable reactions of foreign governments are discussed. The author concludes that the results of the debenture plan for wheat would be highly disappointing.

Farmers' cooperation in New Jersey, 1926, C. B. HOWE (*New Jersey Stat. Bul. 487 (1929), pp. 95*).—This is a general description of the development and status in 1926 of farmers' cooperative purchasing, marketing, bargaining, credit, and cow-testing organizations in New Jersey.

Data are given regarding the details of organization and past operation of cooperative associations for different purposes and for different commodities, the present activities, and the policies of the associations. The legislation from 1875 to 1924 pertaining to cooperative associations and the leading provisions of the 1924 law are discussed, and the text of the 1924 law is appended.

The cooperative pattern in cotton, R. H. MONTGOMERY (*New York: Macmillan Co., 1929, pp. XVIII+335, fig. 1*).—The pre-cooperative system of cotton marketing, the proceedings at the national convention of the American Cotton Association at Montgomery, Ala., in 1920, and the organization, operation, functions and price policies, contract, financial problems, and control of the Texas Farm Bureau Cotton Association are described and discussed.

Problems in cooperation and experiences of farmers in marketing potatoes, T. B. MANNY (*U. S. Dept. Agr. Circ. 87 (1929), pp. 24*).—This circular is based upon a study, made in cooperation with the Maryland and Virginia Experiment Stations, of cooperative marketing of potatoes in the Eastern Shore area of Maryland and Virginia. The development of the marketing problems and past cooperation among growers of the area are described, and the degree to which the fundamental marketing functions are being met and the organization requirements for successful cooperation are discussed.

Business analysis of the Tobacco Growers' Cooperative Association, J. C. SCANLON and J. M. TINLEY (*U. S. Dept. Agr. Circ. 100 (1929), pp. 152, figs. 20*).—This circular reports the results of a study made with a view of enabling other cooperators and cooperatives, especially those dealing with tobacco, to benefit by the policies, mistakes, and experiences of the Tobacco Growers' Cooperative Association. The main sources of information and data were the Department's records, the files and records of the association, interviews with officials and others in intimate touch with the operations of the association, and questionnaires filled in after interviews with about 700 members of the association. The status of the tobacco industry in Virginia, North Carolina, and South Carolina, the factors leading to the formation of the association, the developments during the organization period and membership campaign, and the internal organization of the association are described.

The causes contributing to the failure of the association, members' responsibility for the failure, and the management policies and their relation to the failure are discussed, as are also the progress made during the operation of the association, the benefits derived from and the harmful effects of the asso-

ciation, and the possibilities of future organization of the tobacco growers of the area. A plan is suggested for the cooperative marketing of tobacco.

An appendix includes tables and the articles of incorporation of the association, the association's agreement, the member's agreement with the association and a modified order for the receivers of the association.

Crops and Markets, [October, 1929] (*U. S. Dept. Agr., Crops and Markets* 6 (1929), No. 10, pp. 377-416, figs. 2).—Included are the usual tables, graphs reports, and notes, together with tables showing the grain elevator storage capacity in the principal grain centers of the United States; the farm mortgage indebtedness, by States, January 1, 1925, and January 1, 1928, on owner operated, tenant-operated, and manager-operated farms; the average gross and cash incomes, 1924-1928, from crops and livestock, by States; and the estimated gross income from farm production in the States, by commodities, 1928.

Ohio agricultural statistics for 1928, G. S. RAY, T. F. McDONOUGH, and R. E. STRASZHEIM (*Ohio Sta. Bul.* 442 (1929), pp. 50, fig. 1).—Statistics for 1928 with comparative figures for previous years are given for the leading crops different kinds of livestock, poultry, and dairy and poultry products. The data were assembled in cooperation with the U. S. D. A. Bureau of Agricultural Economics.

Statistics in social research, D. S. THOMAS (*Amer. Jour. Sociol.*, 35 (1929) No. 1, pp. 1-17).—Analysis is made of the author's *Social Aspects of the Business Cycle*¹ for the purpose of exemplifying the compromises inherent in statistical sociological investigations and the value of statistics as a tool in social research.

Principles of rural-urban sociology, P. SOROKIN and C. C. ZIMMERMAN (*New York: Henry Holt & Co., 1929, pp. XV+652, figs. 4*).—This is a treatise in rural and, to a less degree, in urban sociology. The fundamental tasks of rural sociology outlined are "to describe the relatively constant and universal traits or relations of the rural social world as distinct from the nonrural or urban social universe," and "'to explain' these differences or the specific traits of rural social phenomena." The volume differs from existing texts in rural sociology in that it is "not a mere collection of various data pertaining to aspects of rural life and rural communities," that it "does not try to 'preach and does not bother itself with any evaluation of what is good and bad in rural life," that it tries to base its conclusions on the existing data of almost all countries rather than on American data alone, that several problems which have already been well studied and in which relatively certain conclusions have been reached are only briefly summarized, and that it is not given to "all embracing, clearly cut. and sweeping generalizations" or "ready-made conclusions."

The material is handled in an introductory chapter defining rural and urban sociology and five parts as follows:

Part 1 on the rural world and the position of the farmer-peasant class in the "great society" includes chapters on the definition of rural and urban worlds and the status of the farmer-peasant class among other social classes.

Part 2, dealing with bodily and vital traits of the rural-urban populations includes chapters on bodily differences between, comparative health of, and comparative longevity and mortality of, the rural and urban populations predominant diseases of the city and the country; and rural-urban suicides birth rates and vitality, and marriage.

¹ London: George Routledge & Sons; New York: E. P. Dutton & Co., 1925, pp. XV+217 figs. 18.

Part 3 on rural-urban intelligence, experience, and psychological processes includes chapters on rural-urban intelligence and mental disease, and the experience worlds and the psychological processes of the rural-urban populations.

Part 4, dealing with a cross-section of rural-urban behavior, institutions, and culture, includes chapters on sources and theories concerning the psycho-social traits of farmers and peasants; the rural and urban family: comparative criminality, immorality, and intemperance; the rôle of the city and the country in innovation, disruption, and preservation of the national culture; rural-urban religious culture, beliefs, and convictions, and rural-urban arts and esthetic culture; political culture, attitudes, and behavior of rural groups; agricultural classes and political régimes; and farmer-peasant attitudes of individualism and collectivism.

Part 5 on rural-urban migration includes chapters on trends in, and factors of, recent migration; age and sex selectivity of urban migrations; further considerations of "selective" selection; the map of horizontal migration and vertical circulation of rural-urban migrants; and retrospect, present situation, and prospect.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Cooperative extension work, 1927, C. B. SMITH (*U. S. Dept. Agr., Coop. Ext. Work, 1927*, pp. 122, figs. 29).—This report of cooperative extension work in agriculture and home economics of this Department and of the State agricultural colleges covers the year ended June 30, 1927, as regards funds, and the year ended December 31, 1927, as regards results of work.

The funds and staff; significant results; emergency activities; methods of teaching; the organization, activities, extent of work, problems attacked, and the methods and results of county agricultural agent, home demonstration, and boys' and girls' 4-H club work; extension work with negroes; and farmers' institute work are described and discussed. The economic results of the different lines of work are reported and described. Pages 84-122 are devoted to statistical tables.

FOODS—HUMAN NUTRITION

Index to the literature of food investigation, compiled by A. E. GLENNIE (*[Gt. Brit.] Dept. Sci. and Indus. Research, Index Lit. Food Invest. No. 1 (1929)*, pp. IV+85).—As explained in the prefatory note by W. B. Hardy, this is the first of a series of annotated literature references on food investigation to be issued semiannually by the Low Temperature Research Station, Cambridge, England. In a brief historical review a few of the earlier papers dealing with important advances in the subject of food preservation, particularly the theoretical aspects of cold storage, are listed and discussed. In the bibliography proper the literature references are arranged in nine sections, dealing with the principal food groups, followed by six sections dealing respectively with the theory of canning, theory of freezing and chilling, bacteriology, mycology, engineering, and miscellaneous.

Reindeer recipes, L. STANLEY and F. W. YEATMAN (*U. S. Dept. Agr. Leaflet 48 (1929)*, pp. 8, figs. 7).—This addition to the series of popular leaflets on food preparation (E. S. R., 62, p. 90) is a joint contribution of the Bureaus of Home Economics and Biological Survey and gives a brief discussion of the food value of reindeer meat and methods of preparing the different cuts. This is followed by a series of recipes for cooking the roasts, steaks, and chops in a variety of appetizing ways. Directions are given for cooking reindeer liver, which, it is said, compares favorably in tenderness and flavor with that from

other meat animals. The illustrations show some of the more typical cuts and methods of preparation.

The relation of hydrogen-ion concentration and buffer value to the baking quality of flour. Part II, E. A. FISHER and P. HALTON (*Cereal Chem.*, 6 (1929), No. 2, pp. 97-115, fig. 1).—The investigation noted previously (E. S. R., 61, p. 586) has been extended to a great variety of flours over wide ranges of H-ion concentration (from pH 7.8 to 4.2) and with varying periods of fermentation. The results obtained confirm the conclusion reached in the earlier investigation that H-ion concentration is of little importance in determining dough or loaf characteristics. The effects most commonly but not always noticed were increased dough toughness, more pronounced flavor, and improved color of the crumb.

Correlation between diastatic power of flour and crust color in the test loaf, and its significance. M. J. BLISH, R. M. SANDSTEDT, and H. PLATENTUS (*Cereal Chem.*, 6 (1929), No. 2, pp. 121-127).—The statement made by Blish and Sandstedt (E. S. R., 59, p. 590) that with proper control of environmental conditions in the fixed experimental baking test crust color "furnishes almost as useful an indication of diastatic value as does a special diastatic value determination" is substantiated by experimental data on test loaves baked from 84 different flours. The diastatic power of the individual flours was determined by a colorimetric procedure based upon the one proposed by Willaman and Davison (E. S. R., 52, p. 111). The crust colors were classified in 9 groups in increasing depths of colors, the loaves being grouped independently by two workers. Coefficients of correlation were determined for the crust color and diastatic value, using the fixed method without added sugar and with 5 gm. of sugar, and between crust color and residual sugar. These correlation coefficients ranged from 0.65 to 0.75.

Common storage of vegetables: A discussion of the factors involved.—Sundried vegetables (*Oklahoma Sta. Circ.* 75 (1929), pp. 8).—The first part of this circular consists of a general discussion, by M. Benoy, of the changes taking place in vegetables on storage and the requirements which must be made for satisfactory storage, with a summary of temperature and humidity conditions for successful storage of different vegetables. The prospects for common storage of vegetables in Oklahoma are considered poor unless properly insulated cellars are used.

As a substitute for storage sundrying is suggested and the second part of the circular consists of the report, by Benoy and G. Steininger, of experiments conducted to determine what vegetables may be dried satisfactorily under Oklahoma conditions. The vegetables tested included corn, carrots, tomatoes, onions, cabbage, pimentos, green peppers, beets, beet leaves, okra, and potatoes. Some of these were parboiled or blanched before drying and others simply cut in thin slices. All were dried in homemade racks placed outside the laboratory windows, three days being allowed for drying. The dried materials were stored in a dark closet for at least six months and then cooked after varying periods of soaking in water. Of the different vegetables tested, okra gave in all respects the most satisfactory dried product, with beets ranking second and onions and beet greens coming next.

The study, while not exhaustive, is considered to demonstrate that certain vegetables can be preserved satisfactorily in Oklahoma by sundrying.

Ice creams frozen without stirring. L. STANLEY and J. A. CLINE (*U. S. Dept. Agr. Leaflet* 49 (1929), pp. 8, figs. 11).—This leaflet contains a brief popular discussion of the principles of freezing without the use of a dasher, followed by recipes for plain and fruit mousses which may be frozen either in the trays of a household mechanical refrigerating unit or in a mold packed in

ice and salt. Heavy cream, it is stated, is the best base for this type of ice cream, but if it is used in large proportions it makes an expensive and overrich dessert. To keep down cost and richness, directions are given for diluting the heavy cream with thin cream, rich milk, or evaporated milk and for using gelatin, egg yolks, or flour as a thickener. The recipes also call for well-beaten egg whites as another means of insuring smoothness of texture and holding down the fat content. Suggestions are given for varying the flavor as well as the ingredients in the standard mousse recipe. Half-tone illustrations show how to combine the ingredients in this type of mixture and the equipment needed for freezing with crushed ice and salt, and pictures as well as text suggest to the home maker a variety of attractive ways of serving these easily made desserts.

Children of pre-school age in selected areas of South Carolina, M. E. I'BYSEY (*South Carolina Sta. Bul.* 260 (1929), pp. 80, figs. 4).—This study of the food habits, hygiene, and general nutritive condition of rural children of preschool age in South Carolina is based upon a survey conducted in three school districts in each of four counties selected as being typical of different sections of the State. The records were obtained for 541 children, of whom 350 were white and 182 negro. The information on food habits and hygiene was secured chiefly in the homes by questioning the mothers. Physical examinations by county health officers and nurses were secured for 264 of the children. The sanitary conditions and hygienic habits observed are discussed in considerable detail, and the dietary habits are considered with reference to their adequacy in the so-called foundation foods and in relation to the economic status of the family.

The optimum score for judging the diets and the averages for each dietary group secured by the white and negro children, respectively, were milk 1 qt. a day optimum 40, white children 27, and negro 15; eggs four times a week 15, 15, and 10.5; vegetables other than potato 1½ servings a day 13, 4.7, and 3.9; potatoes once a day 5, 5, and 5; tomato juice and raw or cooked fruits twice a day 15, 3.8, and 3; cereals 1½ servings a day 5, 4.3, and 5; bread 1½ servings a day 5, 4.3, and 4.3; and total 100, 64.1, and 51.7 per cent.

As compared with the Woodbury height-weight standards only 60.6 per cent of the white and 49 per cent of the negro children examined were of normal weight. Thirty-six per cent of the white and 38 per cent of the negro children examined had carious teeth, and 28 per cent of the white and 22 per cent of the negro children defective tonsils.

Low economic status was found to be accompanied by inadequate diet and poor housing, and improved economic status usually but not always by more adequate diet, but invariably by improved housing.

In regard to possibilities of bettering the diet, it is thought that more might be done in the way of vegetable gardens throughout the year. Many fruits and vegetables which could easily have been grown in the counties studied were neither grown nor used, although some of the families could have purchased them. Lack of knowledge by the parents of the food requirements of children is also emphasized.

Milk consumption and the growth of school-children, M. L. CLARK (*Lancet* [London], 1929, I, No. 24, p. 1270).—A small scale demonstration of the value of supplementary milk feeding for rural school children is reported in connection with the much more extensive study conducted on the same lines with urban children, as reported by Orr (*E. S. R.*, 60, p. 192) and by Leighton and Clark (*E. S. R.*, 61, p. 587). Although the numbers (10 in the control and 19 in the milk group) were too small to warrant definite con-

clusions, it is considered of interest that the children receiving milk gained more in weight and height than the control children during the experimental period (October, 1928, to May, 1929) and were in better physical condition. "We know that during the last decade a great improvement has taken place in the health of the school child in towns. This glimpse of a small rural community would suggest the probability that the children in such districts may also require further aid to assist them to attain to better physical condition and growth."

Underweight and overweight in relation to vitality, W. R. P. EMERSON and F. A. MANNY (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 6, p. 457, fig. 1).—From the medico-actuarial studies issued in 1912, the authors have plotted the mortality figures for the respective age groups against weights in order to determine the relation of underweight to mortality. The curves show that in the early twenties mortality increased about 1 per cent for each pound below the average weight for height. In the later twenties there was an increase of 0.75 per cent in the mortality rate for each pound underweight and in the thirties an increase of from $\frac{1}{2}$ to $\frac{1}{3}$ of 1 per cent. Above the age of 35 the mortality increased about 1 per cent for each pound above the optimum weight.

The effect of sun and air and air baths on the respiratory gaseous exchange in man, W. A. JAKOWENKO (*Amer. Jour. Hyg.*, 10 (1929), No. 1, pp. 165-182, figs. 3).—In this paper, translated from the Russian by I. Gerbatch, data are reported and discussed on the metabolism as determined by the Zuntz-Geppert method of six subjects of varying ages before, during, and after air and sun baths on the beach at Eupatoria, the Crimea.

In five of the six subjects the average values for basal metabolism after a fast of 12 hours and an hour's rest in bed were higher than the Harris-Benedict standards. This is attributed to the general condition and life at a health resort such as the sanatorium at which the study was made. All of the subjects showed an increase in metabolism during air and sun baths, although the degree of increase was not at all constant. The subsequent decrease occurred more slowly than the increase. During air baths with protection from the sun there was also an increase in the metabolism, most marked at low air temperatures.

A comparison of the metabolic changes with meteorological conditions led to the conclusion that the changes in metabolism during sun and air baths depend upon a combination of factors, some of which tend to lower and some to increase the metabolism. Low temperatures and air movement tend to decrease, and high temperatures, decreased air movement, and increased solar radiation to raise metabolism. In the opinion of the author "a moderate increase in the gaseous exchange of man should be the purpose of climatic treatment. The latter proves to be beneficial to a diseased and exhausted body, due to its production of an increased activity of specific vegetative organs (the liver, the heart, etc.), that of the endocrinous system, and of the oxidating processes in the tissues."

The influence of menstruation on gaseous metabolism, R. F. MATTERS (*Aust. Jour. Expt. Biol. and Med. Sci.*, 6 (1929), No. 2, pp. 133-135, figs. 2).—Data obtained with the Benedict portable apparatus are reported on the basal metabolism of two normal female subjects at frequent intervals during the menstrual cycle. The findings confirm those of Benedict and Finn (*E. S. R.*, 60, p. 392) in showing a premenstrual rise in metabolism, followed by a fall during the menstrual period.

A study of calcium metabolism in the human female, R. F. MATTERS (*Aust. Jour. Expt. Biol. and Med. Sci.*, 6 (1929), No. 2, pp. 119-125, figs. 5).—

Data on the blood calcium during the menstrual cycle have been obtained from over 70 hospital patients during a period of nearly three years. In 30 cases sufficient consecutive data were obtained for comparison. These show consistently a premenstrual rise in blood calcium, followed by a fall at the beginning of the menstrual period, the variation being not less than 5 per cent of the normal calcium level.

The utilization of fatty oils given parenterally, M. KOEHNE and L. B. MENDEL (*Jour. Nutrition*, 1 (1929), No. 5, pp. 399-443, figs. 9).—An extensive investigation of the utilization by rats and dogs of butter oil, cod-liver oil, coconut oil, and peanut oil administered intraperitoneally, intramuscularly, and subcutaneously is reported in detail, together with observations of the utilization of the vitamins contained in butter oil and cod-liver oil.

Both vitamins A and D in cod-liver oil were utilized when the oil was administered parenterally, but the oil itself was treated by the body as an irritating foreign substance. The vitamin A of the butter oil was also utilized. The oil itself, while lacking the irritating properties of cod-liver oil, was not utilized to any appreciable extent. Coconut oil injections caused no local irritation, and some evidence was obtained of a sparing effect on protein metabolism. There was some evidence that adult rats were able to utilize some of the peanut oil administered parenterally, but there was no evidence of utilization of it by the dog. The authors conclude that "fats administered parenterally are generally too slowly metabolized to exert a sufficient influence on nitrogen catabolism to make this method of evaluation practicable."

Can fats be utilized parenterally? (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 5, pp. 382, 383).—An editorial discussion based upon the paper noted above.

Growth of rats on "fat-free" diets, A. J. McAMIS, W. E. ANDERSON, and L. B. MENDEL (*Jour. Biol. Chem.*, 82 (1929), No. 2, pp. 247-262, figs. 10).—In connection with an investigation by Mendel and Anderson of the relation of diet to the quality of body fat (*E. S. R.*, 56, p. 761), albino rats were fed from weaning a ration practically devoid of fat and records made of growth and of the condition of various organs on autopsy. The diet consisted of extracted casein, sucrose, Osborne and Mendel's salt mixture, Harris yeast concentrate, a cod-liver oil concentrate, irradiated ergosterol, and a hot water extract of liver. In certain cases this was supplemented by very small amounts of fat in the form of vitamin A-free peanut oil, and in others cod-liver oil was administered in place of the concentrate.

Comparatively good, but not optimal, growth was secured when 20 mg. of the cod-liver oil concentrate daily served as the sole source of vitamin A. There were only slight differences in growth when an equivalent amount of cod-liver oil was fed in place of the concentrate, but slightly better growth was made by rats receiving a drop (about 20 mg.) of peanut oil in addition to the concentrate. The best gains were made by the rats receiving as a supplement to the basal ration one drop each of cod-liver oil and peanut oil. In general the animals receiving the most fat grew the best.

On autopsy gelatinous masses were found in the bladders of half of the animals receiving the cod-liver oil concentrate as compared with only 1 out of 5 of those receiving supplements of either cod-liver oil or cod-liver oil and peanut oil. The kidneys of half of the rats receiving no fat were mottled. In 3 rats which were fed the concentrate only after the depletion of the stores of vitamin A, urinary calculi were found, and in 1 the right kidney was almost completely disintegrated. "These findings suggest that all damage due to dietary deficiencies is not completely repaired upon supplying the lacking component of the food—an illustration of a fact not always appreciated in the

quantitative tests of the vitamin content of foods, as all 'curative' methods may be rendered ineffective by previous irremedial conditions due to the depletion in an organism of a dietary essential."

Abnormalities in the lungs were noted in more than half of the rats receiving the cod-liver oil concentrate from the beginning of the experimental period, but in none of those receiving fat. In the living animals various abnormalities, such as poor condition of the fur and of the eyes, and a gangrenous condition of the tail occurred among those receiving the least fat.

Although these results showed quite clearly the beneficial effects of small amounts of fat in the diet, the authors consider that it has not yet been demonstrated conclusively "whether this apparent beneficial effect of a small amount of fat is due to its content of vitamin A or other vitamins, or to its action as a vehicle for the fat-soluble vitamins, or whether fat per se is essential."

A new deficiency disease produced by the rigid exclusion of fat from the diet, G. O. and M. M. BURR (*Jour. Biol. Chem.*, 82 (1929), No. 2, pp. 345-367, *figs. 11*).—Evidence is presented leading to the conclusion that fats are essential constituents of the diet (of the rat).

The basal diet employed was a slight modification of diet 519 of Evans and Burr (*E. S. R.*, 59, p. 489). the principal changes being that the sucrose was no longer purified by recrystallization from 80 per cent alcohol and that the casein was prepared from high grade curd casein instead of fresh milk. The technic for its purification is described in detail. The diet also contained McCollum's salt mixture 185, Northwestern pure dehydrated yeast extracted for 48 hours with ether in a Soxhlet apparatus as a source of the vitamin B complex, and the nonsaponifiable matter from high grade cod-liver oil as a source of vitamins A and D. In making up the diets attention was paid to the nutritive ratio, which was fixed at 1:3 for rats at weaning and changed to 1:5 when they reached 100 gm. in weight and 1:7 at 175 gm. "The advantages of this gradual change in nutritive ratio are three: (1) Adequate protein for early growth is assured without taxing the kidneys in later life. (2) Even carefully purified casein is the chief source of organic impurities in the basal ration, and this factor is greatly reduced by partial replacement of casein by sucrose as the animal grows older. (3) The cost of the purified casein is so great that it should not be used as energy food except for special experiments." The quantity of salt mixture was arbitrarily fixed at 1 gm. per 100 calories of diet.

When rats are placed at weaning on this fat-free diet an abnormal scaly condition of the skin is observed between the seventieth and ninetieth day of life. This may develop into true necrosis, with loss of part of the tail. Other symptoms are swelling of the hind feet; loss of hair, especially about the face, back, and throat; appearance of sores on the skin; and cessation of growth, followed after some weeks by decline in weight. With the exception of the skin and tail lesions, the most marked pathology is said to be in the urinary tract and kidneys.

Lard in amounts as small as 10 drops daily prevents and cures this condition. The activity appears to lie in the saponifiable rather than the unsaponifiable fraction of the lard. In discussing the probable reason for this fact, attention is called to an earlier paper of Krogh and Lindhard (*E. S. R.*, 44, p. 463) in which the possibility is suggested of a fat minimum and consequent strain on the body in long continued fat synthesis in the absence of food fats. Another possibility suggested is that the body requires a special type of fatty acid which it is unable to synthesize. "If the effect is not due to the ordinary fatty acids, then we must look for a new substance of the nature of an

ether-soluble organic acid which must be present in exceedingly small amounts. This acid would be classed as a vitamin until its isolation permitted the assigning of a definite chemical formula and name. No conclusion can be drawn from the data at hand, and for the present we will speak of this dietary deficiency as due to the absence from the diet of the acids present in fats."

Sparing action of fat on the antineuritic vitamin B. H. M. EVANS and S. LEPKOVSKY (*Jour. Biol. Chem.*, 83 (1929), No. 2, pp. 269-287, figs. 6).—An extension of the investigation noted from a preliminary report (*E. S. R.*, 60, p. 791) is reported with results confirming the conclusion that fat exerts a sparing action on the antineuritic vitamin B (F). This was found to be most marked on diets in which sugar formed the source of energy, but was also evident with starch. In the absence of the antineuritic vitamin from the diet relatively more fat was required than in the presence of this vitamin, but there was no appreciable difference between small and large amounts of the vitamin. Various fats, including lard, butter, corn oil, coconut oil, and walnut oil, showed the sparing action. It is suggested that fats may possibly act indirectly through their beneficial effect on the microorganisms in the intestinal tract of the rat. That the effect is due to contamination of the fats with the vitamin itself is considered ruled out by the failure to detect antineuritic properties in concentrates of the oils used. Little or no sparing action of the fats for the heat-stable vitamin G could be demonstrated.

Fat as an essential article of diet (*Lancet [London]*, 1929, II, No. 11, pp. 565, 566).—In this editorial discussion of the above-noted papers by Burr and Burr and Evans and Lepkovsky the comment is made that in both series of observations there is "certain common ground for suspecting that the B-vitamins are involved in explaining the part played by the fat. Inclusion of fat in the diet might operate on the organism in many other ways than straightforwardly as a correction of a simple deficiency of fatty acids. The biological study of the B-vitamins is set about with the most thorny difficulties, such as are introduced by the habit of coprophagy and the phenomenon of refection, and it is perhaps rather hasty to interpret these observations on rats as evidence of a new deficiency disease."

Vitamins in food materials. S. L. SMITH (*U. S. Dept. Agr. Circ.* 84 (1929), pp. 55, pls. 3).—A brief nontechnical statement of the function of each of the vitamins thus far differentiated is followed by a table showing the relative distribution of vitamins A, B, and C in a large number of foodstuffs, many of them in both raw and prepared form. Supplementing the occurrence data is a selected list of references to the literature classified for those interested in consulting the sources upon which the occurrence values are based and for laboratory workers desiring authoritative information on research technique for the vitamins. The illustrations, prepared from animals grown in the laboratories of the Bureau of Home Economics, show typical symptoms of vitamin A, B, F, and G deficiency in rats and the effect of vitamin C in the diet of the guinea pig.

Vitamin content of kale and mustard greens (*Kentucky Sta. Rpt.* 1928, pt. 1, pp. 23, 24).—In this progress report it is stated that fresh or cooked kale fed as 20 per cent of the total food intake (about 2 gm. daily) prevented ophthalmia in first generation rats, but that fresh, cooked, and canned kale in the same proportions did not prevent ophthalmia in the second generation. During the 8-weeks test period for second generation rats, those receiving 20 per cent fresh kale showed an average gain of 25 gm., those on cooked kale 15 gm., while those receiving canned kale did not gain in weight.

Rickets was not prevented by fresh, cooked, or canned kale or by fresh or cooked mustard greens as the sole source of vitamin D.

In the vitamin C tests scurvy was prevented by 0.75 gm. daily of fresh kale, 3 gm. of cooked kale, and 1 gm. of fresh mustard greens, but not by 0.5 gm. of the mustard greens.

Vitamin A as an anti-infective agent: Its use in the treatment of puerperal septicaemia, E. MELLANBY and H. N. GREEN (*Brit. Med. Jour.*, No. 3569 (1929), pp. 984-986).—Five case reports are given and discussed on the treatment of human puerperal hemolytic streptococcal septicemia with concentrates of vitamin A in accordance with the belief, based on animal experiments (E. S. R., 60, p. 791), that vitamin A is an antiinfective agent. All of the patients made complete though gradual recoveries, while in the same hospital the records for the two years prior to vitamin A treatment for the same condition were in 1927 8 cases with 2 recoveries, and in 1928 16 cases with no recovery. In commenting upon these results, the authors state "it is clear that, impressive as are the results described, they are too few in number to allow the deduction that this form of treatment is specific in its nature for septicemia. They do, however, warrant the belief that the animal experiments pointed correctly to the hypothesis that vitamin A plays a part as an antiinfective agent to bacterial infection, and has the property of raising the resistance of the body to such infection."

Experiments on nutrition.—IX, Comparative vitamin B values of food-stuffs, pulses, and nuts, R. H. A. PLIMMER, W. H. RAYMOND, and J. LOWNDES (*Biochem. Jour.*, 23 (1929), No. 3, pp. 546-557).—This investigation was conducted along the same lines as previously described (E. S. R., 55, p. 294), except that maintenance of the pair of pigeons for 26 weeks under the prescribed conditions was used as the standard in place of hatching and rearing of the young. Four per cent of dried yeast proved sufficient to maintain this standard, and to it an arbitrary value of 100 was given. Calculated to the same standard, the values obtained in the present study are as follows: Split peas 13, whole dried green peas 13, lentils 13, Haricot beans 10, soybeans 13, peanuts 20, ground almonds 10, whole almonds 10, hazelnuts 20, dried chestnuts 10, coconut 0, green coffee less than 13, and roasted coffee 0.

It is noted that the values for cereals are much lower than reported in the previous paper of the series (E. S. R., 58, p. 390), when rearing of the young was used as the standard.

The effect of heat on the antineuritic vitamin of milk, A. L. DANIELS, M. L. GIDDINGS, and D. JORDAN (*Jour. Nutrition*, 1 (1929), No. 5, pp. 455-466).—The antineuritic properties of various milk preparations were tested by comparing the growth curves and behavior of suckling rats of mothers receiving rations containing the product under investigation as the chief source of antineuritic vitamin with those of the young of mothers receiving similar rations made with equivalent amounts of quickly boiled milk or rations containing the superheated milk supplemented with autolyzed yeast, wheat embryo extract, or yeast as the source of antineuritic vitamin. In general the procedure followed was that of Hartwell (E. S. R., 53, p. 766). The preparations tested included three types of dried milk, one made by the spray process, one by the roller process, and one a desiccated albumin milk. Three types of pasteurized milk were tested. The first was pasteurized commercially by holding at 145° F. for 30 minutes with agitation in an open glass lined tank and then cooling quickly. The other two were pasteurized by home methods, the first by heating in closed quart glass bottles at 145° in the water bath for 30 minutes and then cooling in running water and the second by heating in an open aluminum saucepan on the water bath for the same length of time. Quickly boiled milk was prepared in three ways: (1) By bringing to the boiling point 1 pint lots in an open pan and cooling as quickly as possible in running

water, (2) by heating the same amounts and pouring into a 3-qt. pail, continuing until the pail was full, allowing it to stand at room temperature for an hour, and then putting it into the refrigerator, and (3) by heating 100 cc. quickly to boiling and cooling quickly to room temperature.

Of the dried milks, the one made by the roller process was the only one in which there was little indication of destruction of the antineuritic vitamin. The types of commercially pasteurized milk were lower in antineuritic vitamin than milk which was boiled quickly or pasteurized by the holding method in closed quart bottles. The milk which was cooled slowly after boiling contained less antineuritic vitamin than the milk which was cooled quickly.

In a further study of evaporated milk (E. S. R., 58, p. 692) in an effort to determine the degree of destruction of the antineuritic vitamin, the milk was fed at increasingly high levels up to 75 per cent, with corresponding adjustments of the other constituents of the ration to maintain the same nutritive ratio. At the higher levels growth was better and convulsions were delayed and were less severe. Contrary to the results reported by Sure (E. S. R., 59, p. 491), the mother rats did not lose weight but either maintained their weight or gained during the lactation period.

The effect of drying and of sulfur dioxide upon the antiscorbutic property of fruits, A. F. MORGAN and A. FIELD (*Jour. Biol. Chem.*, 82 (1929), No. 3, pp. 579-586).—Fresh, completely ripe peaches of the Muir variety were pitted, ground without peeling, packed in small tin containers, frozen hard, and kept in the freezing room until just before feeding. Other samples of the pitted but not ground fruit were dried by several commercial methods, including sundrying with and without sulfuring and dehydrating with and without sulfuring. The vitamin C content of the various samples was determined by the method of Sherman, LaMer, and Campbell, using preventive tests for a period of 90 days.

Daily doses of 8 and 10 gm. of the fresh fruit completely protected 300-gm. guinea pigs from scurvy. Equivalent doses of the unsulfured dried or dehydrated fruit afforded no protection, but the sulfured furnished complete protection. In most cases protection was also secured with the sulfured products in a smaller dosage, 1 gm. of the dehydrated being equivalent to about 4 gm. of the fresh fruit. Amounts as large as 10 gm. of the dried unsulfured fruit equivalent to about 40 gm. of fresh fruit afforded no protection.

These findings are of interest in connection with the long disputed question as to the possible deleterious effects of sulfurous acids in dried fruits. Studies are under way to determine the level of sulfur dioxide at which the protective action upon vitamin C is effective.

Green tea as a source of vitamin C, H. E. MUNSELL and H. B. KIFER (*Jour. Home Econ.*, 21 (1929), No. 7, pp. 514-518, fig. 1).—Japan green tea advertised to be "a rich source of vitamin C" showed no appreciable antiscorbutic properties in protective experiments when administered to guinea pigs in 15 cc. daily doses of an infusion prepared according to specifications worked out by G. F. Mitchell, supervising tea examiner of the United States. The infusion was prepared by pouring boiling water over 2 gm. (1 teaspoonful) of the tea, allowing it to stand for 2 minutes, stirring, and allowing it to stand for another 2 minutes, after which the liquid was poured through a strainer into a beaker containing 4 gm. of sugar and hot water added to bring the volume of the infusion to 125 cc. The guinea pigs receiving 15 cc. of the tea lived on an average 42.7 days, while the negative controls averaged 36.5 days. Those receiving tea made no greater gains in weight and at autopsy showed as severe scurvy symptoms as those of the controls, thus showing that the amount of the vitamin in the tea must have been very small.

The evaluation of vitamin D preparations, I [trans. title], A. SCHEUNERT and M. SCHIEBLICH (*Biochem. Ztschr.*, 209 (1929), No. 4-6, pp. 290-303, figs. 2).—On account of the time involved in curative tests for the quantitative determination of vitamin D, the authors have developed a prophylactic technic depending upon the assumption that upon a suitable rachitic diet rickets can be detected by X-ray examination in 14 days. In the method as described rats were placed at the age of 3 or 4 weeks and a weight of 33 to 42 gm. on the McCollum rachitic diet 3143, together with graded doses of the material to be tested. No less than 10 animals distributed in different litters were used for each amount of the material under investigation. At the end of 14 days the animals were killed and X-ray photographs of the proximal ends of the tibias made for comparison. The amount of the material affording complete protection against rickets to at least 8 of the 10 animals in a group is called the antirachitic protective unit. Three trade preparations of vitamin D, Radiostol, Radiostol, and Präformin (a 1 per cent emulsion of vitamin D in oil), tested by this method and found to have 25,000, 2,000, and 1,000 of these units, respectively, in 1 cc. of the trade preparation.

Vitamin D and fecal reaction, A. L. BACHARACH and H. JEPHCOTT (*Jour. Biol. Chem.*, 82 (1929), No. 3, pp. 751-758, fig. 1).—This paper consists chiefly of a reply to criticisms of the authors' method of determining vitamin D changes in the fecal reaction (*E. S. R.*, 59, p. 293) by Coward (*E. S. R.*, 59, p. 689), Shohl and Bing (*E. S. R.*, 60, p. 494), and Oser (*E. S. R.*, 61, p. 94). It is pointed out that the experimental conditions prescribed, including the basal diet, must be followed exactly, that the test is of quantitative value only with relatively large doses of vitamin D in relatively high concentration, and that it was never designed as a test for rickets, but as a means of measuring vitamin D. If the test is to be used for the assay of vitamin D in sources which are not concentrated, two alternative procedures are suggested: (1) The extraction of the active constituent with ether and, if necessary, further concentration as the nonsaponifiable fraction and (2) the substitution of the most comparable constituent of the diet by an equivalent amount of the material being tested. Data are reported on the use of the second of these methods for determining the antirachitic potency of Quaker Oats irradiated for different lengths of time. The minimum mean fecal reaction of groups of rats receiving nonirradiated Quaker Oats was pH 7.16, of those receiving the material irradiated for 5 seconds 6.97, 15 seconds 6.76, and 30 seconds 6.57.

Composition of bone.—VI, Effect of massive doses of irradiated ergosterol, B. KRAMER, M. J. SHEAR, and M. R. MCKENZIE (*Jour. Biol. Chem.*, 82 (1929), No. 3, pp. 555-557).—In this continuation of the series of studies most of which have been noted previously (*E. S. R.*, 60, p. 388), the bones of the rats used by Klein in his investigation of the composition of the blood after prolonged treatment with massive doses of irradiated ergosterol (*E. S. R.*, 61, p. 391) were analyzed for calcium and phosphorus by the method of Shear and Kramer (*E. S. R.*, 60, p. 312), with the exception that phosphorus was determined by the technic of Fiske and Subbarow (*E. S. R.*, 55, p. 310) instead of by the Briggs-Bell-Doisy method.

The mean value of all of the ratios $\frac{\text{residual Ca}}{\text{P}}$ was 2.00 ± 0.05 , as compared with a mean value of 1.90 ± 0.05 previously reported by Kramer and Shear for normal rats (*E. S. R.*, 60, p. 388). The mean values for the bones of the control rats were legs 2.09 ± 0.09 and ribs and spines 2.02 ± 0.02 . Corresponding values for rats receiving irradiated ergosterol were 2.03 ± 0.03 and 2.00, and those receiving cod-liver oil 1.91 ± 0.09 and 1.93 ± 0.07 , respectively.

The effect of avitaminosis on hematopoietic function, I—III, B. SURE, M. C. KIK, and D. J. WALKER (*Jour. Biol. Chem.*, 83 (1929), No. 2, pp. 375–408, figs. 7).—Three papers on the effect of deficiencies of single vitamins upon the anemia produced in rats by repeated bleeding are reported as follows:

I. *Vitamin A deficiency* (pp. 375–385).—This study, conducted on 11 rats, has led to the conclusion that in the preophthalmic stage of vitamin A deficiency there is a suggestion of an anemia characterized by reduction in either hemoglobin or erythrocytes, but that inanition so complicates the later ophthalmic stage that the high figures of hemoglobin and erythrocytes noted may be an expression of anhydremia rather than of any specific effect of vitamin deficiency on the composition of the blood.

II. *Vitamin B deficiency* (pp. 387–400).—This investigation included studies of the effect of a deficiency of the vitamin B complex and of vitamin B (F) on the hematopoietic function of rats. The deficiency of the complex was studied on two groups of adult female, the first consisting of 18 rats, all but 2 of which had failed to rear young because of an insufficiency of the B complex and which were continued on the deficient diet and the second of 21 females which had successfully reared and weaned litters and were placed on the B-deficient diet after from 3 to 6 weeks. In some cases vitamin therapy was instituted later in the experiment and the other rats were killed at different periods. In the study of what is termed uncomplicated vitamin B (vitamin F) deficiency, rats were taken at weaning and half were given a diet deficient in the B complex and the other half the same diet supplemented with autoclaved yeast.

The principal changes resulting from a deficiency in the vitamin B complex were reduction in the concentration of serum proteins following heavy losses in weight and fluctuations in the concentration of hemoglobin and red blood corpuscles from a small reduction in the early stages to a marked rise in the final stages. The rise was associated with marked anhydremia produced by pronounced inanition. When the loss of body weight was prevented by feeding suboptimal amounts of the vitamin B complex, the anhydremia became apparent. No specific effect was noted on the total leucocyte counts.

Deficiency in vitamin B was followed by a marked increase in the concentration of serum proteins, indicative of anhydremia. As in the case of the vitamin B complex, there were fluctuations in the hemoglobin and red blood corpuscles but no evidence of definite anemia.

III. *Vitamin E deficiency* (pp. 401–408).—This study was initiated during the period in which the theory was held by McCollum and coworkers that lack of vitamin E was responsible for certain types of anemia on account of a supposed association between vitamin E and iron. The results obtained show that vitamin E has no influence on the hematopoietic function of female rats during the period of resorption of the fetus as a result of previous lack of this vitamin, and that neither ferric citrate nor the ash of lettuce leaves is effectual in the prevention of female sterility produced by vitamin E deficiency.

Inorganic elements of spinach in treatment of nutritional anemia, H. S. MITCHELL and L. MILLER (*Soc. Expt. Biol. and Med. Proc.*, 26 (1929), No. 2, pp. 835, 836).—In an attempt to determine whether inorganic factors other than iron and copper play a rôle similar to these elements in the synthesis of hemoglobin in the animal body, a concentrated water-soluble extract of spinach was fed to rats rendered anemic by a whole milk diet in amounts sufficient to supply 0.5 mg. of iron per day. The response was much more rapid than to the iron and copper combination, and the ultimate level of hemoglobin was 25

per cent higher. The ash of this extract weighed out, dried, and mixed with the milk did not prove as effective as the original extract, but when dissolved in a small amount of concentrated hydrochloric acid and diluted proved as effective. It is concluded that the combination of inorganic salts naturally present in spinach is better than any combination of inorganic salts which the authors have been able to find, and that the solubility of some of the factors may be of significance.

Radiological study of motility of gastro-intestinal tract of rachitic rats, L. J. MENVILLE, S. N. BLACKBERG, and J. N. ANÉ (*Soc. Expt. Biol. and Med. Proc.*, 26 (1929), No. 9, pp. 753-766).—In this preliminary report, data are summarized on the motility of the intestinal tracts of 20 rachitic and 20 normal rats as determined by the emptying time of various parts of the intestinal tract following a barium sulfate-buttermilk test meal.

The average emptying time of the stomachs of the rachitic rats was somewhat longer and that of the small intestines somewhat shorter than of the normal group. The emptying time of the colons was decidedly longer in the rachitic rats. The stomachs of the rachitic rats appeared somewhat atonic and the colons decidedly so.

The Bergeim test for intestinal putrefaction, F. HOELZEL (*Jour. Biol. Chem.*, 83 (1929), No. 2, pp. 331, 332).—A critical examination of the Bergeim ferric oxide test for intestinal putrefaction (E. S. R., 56, p. 192) has led to the discovery that high figures for reduction may be obtained independent of putrefaction. In attempts to estimate the degree of putrefaction in various segments of the digestive tract of rabbits, it was found that the food mixture consisting of fresh ground carrots, oats, and alfalfa caused almost as much reduction as the feces. In vitro tests with plain bread and bread browned to varying degrees showed increasing degrees of reduction of the ferric oxide. It is concluded that the Bergeim test is not specific for intestinal putrefaction.

CLOTHING—HOME MANAGEMENT

Suits for the small boy, C. L. SCOTT (*U. S. Dept. Agr. Leaflet 52* (1929), pp. 8, figs. 8).—The suits described and illustrated in this circular have been designed especially to reduce to a minimum restriction of the muscular activity of the small boy and to do away with complicated fastenings which hinder self-help. Attention has been paid to the attractiveness and suitability of the garments in design and recommended fabrics. Special advice is given for the selection of patterns to insure the proper lines for comfort and fit.

Comparative study of data on farm household expenditures obtained by household accounts and by a survey, M. MUSE and C. P. BROOKS (*Vermont Sta. Bul.* 294 (1929), pp. 82, figs. 10).—This study is based upon accounts kept, under direction, by 13 farm home makers during the year beginning October 28, 1926, estimates of expenditures obtained from the same home makers in a survey made shortly after the completion of the year during which the accounts were kept, and estimates obtained by a survey from 13 other comparable farm home makers. The following table shows the averages for the various items of expenditures included as obtained from the accounts and the surveys:

Average household expenditures as obtained by different methods

	Thirteen families keeping accounts		Thirteen other families by survey
	Accounts	Survey	
Savings.....	\$73.57	\$204.18	\$384.00
Food.....			
Farm-saved by farm.....	401.35	466.10	455.85
Bought.....	390.36	448.16	461.85
Clothes.....	146.51	299.48	327.83
Furnishings.....	33.01	79.83	109.86
Rent.....	342.31	342.31	369.23
Operating expenses.....			
Farm-saved by farm.....	107.84	118.34	128.06
Bought—Lif'ts, fuel, ice, telephone, etc.....	64.60	84.15	116.44
Bought—Supplies, laundry, wages.....	38.75	92.36	76.68
Health.....	35.56	54.06	113.58
Education.....	35.64	120.35	141.89
Recreation.....	29.15	84.11	68.64
Personal.....	45.60	54.01	54.71
Church and charity.....	19.96	35.97	40.23
Other gifts.....	22.87	60.04	26.00
Automobile.....	103.83	127.77	157.37
Miscellaneous.....	15.02	31.23	15.65
Total furnished by farm.....	851.50	928.74	989.06
Total bought.....	1,079.45	1,785.63	2,088.37

Tables are given showing for each family the items included in the table above, and for the 13 families keeping accounts the cost of food purchased and the value of food supplied by the farm, by items, as shown by the accounts and the survey. The reasons for the differences in the various items in the table are discussed.

The data from the survey were found apparently to be more accurate than those from the accounts. The authors conclude that if accurate account data are to be secured, constant personal supervision by frequent visits, simple forms, itemized account sheets, and cooperation on the part of the entire family are necessary, and that an accurate account of total farm income and expenditures would be a very helpful check on the accuracy of the home maker's data.

MISCELLANEOUS

Forty-first Annual Report of [Kentucky Station], 1928, I, T. P. COOPER (Kentucky Sta. Rpt. 1928, pt. 1, pp. 53).—Part 1 of this report contains the organization list, a financial statement as to the Federal funds for the fiscal year ended June 30, 1928, a report of the director on the work and publications of the year, and meteorological data. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

Progress in agricultural investigations: Thirty-fifth Annual Report of the [Montana Station, 1928], F. B. LINFIELD (Montana Sta. Rpt. 1928, pp. 63, fig. 1).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1928, and a report of the director on the work of the station. The experimental work not previously noted is for the most part abstracted elsewhere in this issue.

Report of the Virgin Islands Agricultural Experiment Station, 1928, J. B. THOMPSON ET AL. (Virgin Islands Sta. Rpt. 1928, pp. [2] + 20, figs. 6).—This includes the organization list, reports by the director, the horticulturist, and the agronomist as to the work of the station for the fiscal year ended June 30, 1928, and a special report of the agriculturist for St. Thomas and St. John. The experimental work reported is for the most part abstracted elsewhere in this issue, as are also meteorological observations.

NOTES

California University and Station.—C. B. Hutchison, director of the Giannini Foundation of Agricultural Economics, has been appointed dean of the College of Agriculture and director of the station vice E. D. Merrill, whose resignation has been previously noted. H. R. Tolley, assistant chief of the U. S. D. A. Bureau of Agricultural Economics, has been appointed professor of agricultural economics in the Giannini Foundation and assistant director therein.

At the invitation of the Rockefeller Institute for Medical Research, Dr. J. R. Beach, associate professor of veterinary science and associate veterinarian, is continuing his studies of infectious bronchitis in fowls at the animal pathology laboratory of the institute at Princeton, N. J.

Dr. Patrick B. Kennedy, professor of agronomy and agrostologist, died January 18 following an operation. Dr. Kennedy had been a member of the university faculty since 1914, coming from the Nevada University and Station, where he had served in various capacities since 1900. He was born in Scotland June 17, 1874, was graduated from the University of Toronto in 1894, and received the Ph. D. degree from Cornell University in 1899. He served as associate chemist in the Ontario Agricultural College in 1896 and as an assistant in the Division of Agrostology of the U. S. Department of Agriculture from 1899 to 1900. He was widely known for his studies of range vegetation and related problems.

Montana College and Station.—Dr. J. R. Parker, station entomologist, has resigned effective February 1 to accept a position with the U. S. Department of Agriculture in charge of grasshopper studies in the Western States. He will continue to make his headquarters at the college.

Dr. Erwin Jungherr, assistant professor of veterinary science and assistant veterinarian, resigned effective January 10 to accept a position with the Texas Station and has been succeeded by Dr. E. A. Tunnick of the Texas Substation at Sonora. E. J. Bell, jr., assistant agricultural economist, resigned effective January 17 to accept an appointment with the Federal Farm Board.

Nebraska University and Station.—An appropriation of \$10,000 was made by the last legislature for carrying on experimental work with crops in Box Butte County. This work is to be conducted for a period of eight years in cooperation with the county commissioners, who are to furnish lands and buildings.

Authority was also given by the legislature to dispose of a tract of land purchased some time ago for an irrigation school and to use the proceeds for additional land and improvements at the Scottsbluff Substation.

O. W. Sjogren, chairman of the department of agricultural engineering, resigned on January 1 and has been succeeded by E. E. Brackett.

International Congress of Soil Science.—Recent information as to this congress indicates that its sessions will be opened in Leningrad on July 20, 1930, with the final 6 days (July 26-31) in Moscow. Excursions will be arranged from both cities, and at the close of the congress there will be a trip of 29 days across the soil zones of European Soviet Russia, during which time opportunity will be given for visits to agricultural schools, experiment stations, large scale farm enterprises, etc.

EXPERIMENT STATION RECORD

VOL. 62.

MARCH, 1930

No. 4

Attention was drawn in these columns some months ago to the comprehensive and authoritative history of agricultural education in the United States which had recently been issued by the Federal Department of Agriculture under the authorship of the late Dr. A. C. True. By an interesting coincidence, another volume which discusses some of the questions treated in Dr. True's history appeared well-nigh simultaneously under private auspices. This little booklet of somewhat over 100 pages is entitled *Agricultural Education in the United States*, and its author is one who modestly describes himself as "a man who knows very little about education and nothing at all about practical agriculture." This is Mr. Whitney H. Shepardson of New York City, engaged in active business both before and after "a strange and stimulating interlude" of about four years, in which he made a study of American agricultural institutions under the auspices of the General Education Board. Originally formulated as a report to that board, his findings as derived from talks with a number of well-known leaders in agricultural education and research, a considerable amount of reading, and visits to some 25 institutions in various parts of the country have now been made available for wider dissemination. His observations are very frankly put forward as those of a layman without professional training, but also, as he points out, without the impediments of institutional loyalties.

Following an introductory chapter on the nation and its agriculture, Mr. Shepardson briefly describes the system of agricultural education in the United States and the place which the land-grant colleges hold in this system. He traces the history of these colleges, discusses their function, the way they are fulfilling it, and the means at their disposal, and he ends with suggestions regarding possible future developments.

Mr. Shepardson agrees with Dr. True and most other historians that the Morrill Act "came neither by genius nor suddenly," since the movement toward Federal support for agricultural education had been under way for a long time. He, too, gives large credit to the agricultural societies, and more especially to the influence of "the

new science, the new education, and the new society" of the period between 1840 and 1860, but he regards it as unsound to consider the early schools for instruction in agriculture and industrial arts as precursors of the colleges. "For they were secondary trade schools, planted here and there, where agriculture might be advanced by giving rule-of-thumb instruction to a limited number of youngsters who came from farms and were going back again. There was little or no conception of education through them as education is conceived to-day, and certainly none at all as compared with the formal classical discipline of the conventional American school of 1850. They were specialized, vocational agencies, and they were socially narrowing in the sense that they tended to fix the pupil forever in his station. The youngster, in the scheme of things, was to be tempered into a better tool for the advancement of the agricultural welfare of the nation. Luckily their influence was slight, but the fact of their existence suggested something finer and their great limitations drew attention to greater needs."

As regards Senator Morrill, a view is taken between those of his partisans and his critics. Believing that the land-grant colleges grew out of experience rather than "full armed from the brain of Zeus," and recalling that one higher State institution had been authorized before the Morrill bill of 1857 had been introduced, Mr. Shepardson is equally confident that "if the Senator was no genius, he was likewise no mere politician. . . . Senator Morrill may have builded better than he knew, but the success of his enterprise can hardly be cited as proof of his superficiality. Nor can the suggestion of political opportunism be justly brought against a public man who began in 1857 to labor for the betterment of democratic education in his own country, and might be found in 1890 still laboring successfully to the same end."

The act itself he finds to be, in its provisions, "wise, broad and flexible, capable of meeting local requirements and changing needs," and he deems relatively unimportant the controversies which have raged as to its interpretation. "Far too much time has been spent in attempts to penetrate the mind of Congress in 1862. It seems clear that under the broad and rather ambiguous statute the work of the colleges should proceed not from the intentions of 67 years ago, but from the needs of to-day and of to-morrow."

The first quarter century he regards as "barren enough." The comparative lack of progress he ascribes to inadequate financial support and the need to create both a body of knowledge and a trained instruction staff, but even more largely to the lack of a definite objective. The colleges, he tells us, "felt also, and most acutely, that they were called upon to perform the almost impossible double task of winning the support of practical farmers and secur-

ing the sympathy of hostile educators of the old school. Indeed it was even worse than that. They were continually on the defensive against criticism. The most candid of them saw that they were excusing their failure to produce practical results by asserting an interest in fundamentals; and that in the same breath they were defending themselves against the loftiness of the 'educator' by claiming to serve the public need of the moment. It may be inferred from the rather testy self-consciousness of the men in the land-grant colleges as it appears in conference records and correspondence of the period that they were so everlastingly occupied in maintaining their self-respect that there was little time left to think about their task and get ahead with it."

However this criticism may be regarded, it is of special interest to readers of the *Record* to note the author's full agreement with Dr. True and others that one remedy for the conditions was eventually found in the development of research. In particular he comments with approval on the pioneer work of Dr. S. W. Johnson, as one who was early "proving in fact what he had always maintained in theory—that fundamental research in agricultural science is necessary to the advancement of practice, that work of highest scientific quality can be done under the title of agriculture, and that the sole way of accomplishing the almost impossible double task of gaining respect in the eyes of the practical farmer and the hostile educator is by accomplishing the single task of gaining one's own self-respect first. Of all the discoveries of the remarkable experiment station at New Haven, this last is perhaps the most valuable."

The passage of the Hatch Act in 1887 is rightly deemed an important milestone, recognizing in a substantial way the place of research in the advancement of agriculture and the responsibility of the Federal Government for something more continuous and more comprehensive than what he refers to with too little appreciation as "the spotty work in fertilizers, seed selection, and crop rotation, which had been going on here and there in the United States if and when time and funds permitted." To the work of the stations is ascribed much of the credit for the material expansion and development which followed. "The creation of these stations soon proved to be the step by which the colleges saw the potentialities of their task. A growing body of information tested according to the best scientific knowledge became available, and it became apparent that the colleges were not excrescences upon the body of society, but useful organisms to the state and to the individual. From the moment that they understood that they had work to do, bigger than themselves, basic in character, and affecting half the population of a developing country, they rose in stature and have continued to grow ever since."

Among the specific results accruing between 1887 and 1907 which he believes may legitimately be ascribed to the stations were the following: "In almost every instance they became physically and spiritually associated with the colleges. Their staffs overlapped; their direction was often united in one and the same individual. Out of this connection, textbooks were produced and teaching was made more attractive through accessions of laboratory knowledge. Enthusiasm was maintained by the haven of new discoveries. The relationship of the stations to the college induced more men of scientific training to accept positions on the college staff. Their own achievements and influence lent dignity to the teaching and study of agriculture. They provided a clinic where book learning might be checked and enriched by field practice and experiment. Lastly, by demanding a high type of training for staff positions, the stations gave an impetus to graduate study. Postgraduate qualifications they began to insist upon, until the colleges themselves in the end had to rise and respond to the demand."

For the final 20 years the growth of extension work and to a lesser degree vocational training in agriculture and home economics are deemed the outstanding accomplishments. The extension work has had the practical effect of helping to round out the institutions' scope and influence, not only directly but also through the development of the fields of agricultural economics and home economics. "For the most part, until the extension service found its feet, teaching and research were concerned with the man on the farm and his power to produce. During the last 20 years there has been a phenomenal growth of interest in the women and children and in the man's power to market his produce profitably. These were previously gaps—bad gaps. Now, so far as the structure is concerned, they have been filled in."

Maintaining that there has thus at last come about a nationwide system of agricultural education at whose center, "whether viewed structurally, functionally, or historically, stands the college," Mr. Shepardson attempts to evaluate the services of the colleges and to locate their objectives. He points out that "an annual subsidy of more than \$90,000,000, of which about a third is spent by institutions of higher education on agriculture, forestry, and veterinary science, is a considerable sum of money," but he is equally positive that "there can be no reasonable doubt that every cent that comes out of the nation's pocketbook or out of the State's pocketbook for higher agricultural education is returned to the State and nation many times over."

Citing some specific examples of the economic returns from research alone, he concludes that "sometimes the figures seem arbitrary or extravagant, but even at a drastic discount the economic

services of the colleges and experiment stations run into hundreds of millions each year." The benefits are also increased by the returns from graduate work, which "pays for itself by multiplying leaders in the field of teaching, research, and extension," but he appears to be less certain concerning "the economic value to the State and nation of undergraduate instruction for the profession of farming." "Only one in a hundred farmers the country over," he declares, "go to college; only a third, even of these, go back to the farm after completing their undergraduate studies, and it is arguable that public money spent on these few individuals brings no great social advantage." However, he concludes that while "absolutely this may be so, yet relatively it is not so. The social usefulness of men so trained is doubtless as great as those trained by State universities in the arts and sciences, in law, engineering, dentistry, and medicine. . . . Agriculture or the history of art, B. S. A. or A. B., it is all the same. The chief difference is that, for some reason, the agricultural college or the agricultural division of the State university is held to a strict accounting, while the other branches of education (by some kindly remission) are scarcely ever called upon to total up their return." Moreover, he includes a statement from "a friendly critic" as follows: "I doubt the soundness of this challenge of the undergraduate institution. The gradual infiltration of college trained men into the farming communities is having results of great significance to practical farming. They have already become, and are doing so increasingly, the leaders in both local, county, and State farmers' movements, such as cooperative organizations and societies. Evidence could be brought to bear to show that the national investment is justified, particularly as this same investment can not be segregated for training prospective farmers alone, but is utilized at the same time for all of the other functions of the college, including the training of teachers and investigators."

So firmly convinced, on the whole, is Mr. Shepardson that the agricultural colleges is a sound investment that he suggests that the leaders of higher education may well ignore further criticism in this direction, since "if their present efforts can not convince their critics, nothing can be gained by further enlargement of activities along these lines." What he seems to regard as more important and more serious is the possibility that their research program may be handicapped "by the imagined need of showing results and showing them each year in some way that can be totaled up in figures," and he raises the question, Is the agricultural college "chiefly an educational institution or a service station?"

The answer which he suggests to this question is expressed as follows: "We have two main objectives, one to serve the economic

welfare of the State and nation through improving the science and practice of agriculture and bettering the conditions of rural life, the other to give the best education we can to undergraduate and graduate students to fit them for their future work, which, in all probability, will lie somewhere in the agricultural field. We are conducting an experiment which is partly economic and partly educational."

Admitting that these institutions must continue to discharge this dual function, Mr. Shepardson finds that "there are two elements upon which both economic agriculture and agricultural education depend—one, the discovery of facts and principles now unknown, the other, the dissemination of already known facts and principles to those who are to apply them. The first is the function of research, the second is the function of extension."

"Where the extension idea prevails," he declares, "teaching consists of instruction in practical farming skills, embellished with some science; the number of students admitted provides the criterion of the institution's success, and the standards of admission are relatively low. Though there are exceptions, this is the trend. But there is another conception of the business of an agricultural college which contends with the foregoing that it should primarily train research workers, teachers, and leaders of agricultural progress. Those who believe in this second theory have fought to establish it and have been, in a measure, successful. They have been so successful that no agricultural college has become wholly a vocational school. But they have not succeeded, even in the State universities, in effecting a dedication to the advancement of scholarship, either in the spirit and method of teaching or in the quality of experiment station work."

In some respects this is a severe indictment, yet as a statement of ideals it may well be given serious consideration. Practically speaking, Mr. Shepardson believes that farmers should be trained to be better farmers, but not as a major affair of the colleges. "So far as the farmer is concerned," he proposes, "let him seek the college rather than the college seek him as such. The mountain has gone to Mohammed for more than half a century; let Mohammed come to the mountain for a while. And let him come to get no dogmatic instruction in practical skills which is essentially four years of resident extension, but to get that hard training in experimental science which will turn him out a better educated man as well as a more confident craftsman. There is every reason not to exclude the prospective farmer; but the highest type of scholarship should be required of him. He will not suffer from it. While, per contra, as things now are, to adulterate the scientific work of the institution in order to meet the old-fashioned superficial stipula-

tions for agricultural training, is to fall between two stools and to sit upon neither."

The chief duty of the agricultural college, "to which all other should be subordinated, is to prepare men and women for responsible positions in agricultural research, teaching, and extension." "There is," as he says, "no one of these positions which does not call for a broad education, a vivid imagination, a developed capacity for leadership. And since the highest qualifications are more and more exacted of candidates for these influential positions, so the agricultural colleges should, above all else, prepare them for their work by establishing and maintaining standards second to none in the country."

In the attainment of such an ideal he frankly recognizes that agricultural educational institutions are at a disadvantage. "In the first place, while they deal with the natural sciences and their applications, they also deal with social and economic problems. Again as professional schools, they assume to train both practical farmers and agricultural leaders. These duties, as things are, compete with each other; indeed, so long as any institution tries to accomplish both ends through the same curriculum, there can be little hope of its doing university work. But if it is minded to train leaders in research, teaching, and extension and if it believes that these efforts will be fruitful to the degree to which university ideals prevail, it might be able to realize its belief, without compromise, in some large division of its work. No institution of whatever character would undertake to lift its whole self bodily; it would have neither the funds to do so nor the suitable men. But one essential field in which conspicuous progress has been made over the last quarter century, one which in a commercial age seems to be suffering from the spectacular growth of applied economics, is that of the fundamental sciences. Here, now nearest of all to the university level, there is promise of a development of double service to agriculture and to education."

Mr. Shepardson furthermore refuses to admit that such a program is unduly idealistic. "Surely," he argues, "any matter so basic as agriculture requires the best that our educational régime affords. It is impossible to agree with those who think that the sciences of production need a long, long rest, that it is useless to agitate them further until the agricultural community learns to market what it can now produce. The science of production is nothing but another name for accurate knowledge concerning the laws of plant and animal growth in health and disease, and this knowledge can be put into practice or pigeonholed as economic conditions dictate. More fundamental science means nothing more alarming than more trustworthy knowledge. We can do with a great deal more of that."

However, if the grade of research is to be measuredly advanced, certain conditions are recognized as necessary. "Research staff men must have more time at their command for experimental work—more uninterrupted time for thought—unbroken by calls for 'service,' police duties, too much undergraduate teaching, and too many graduate students. They must be relieved of administrative responsibilities, taken off committees, protected from extension tours, and kept clear of visiting delegations. When the pinch comes, they must have access to funds, either for assistance or for equipment. A few of these conditions depend upon money, the rest depend upon the administrative head of the institution, his clear-mindedness and his courage."

In his concluding chapter, entitled "Observations on Science and Research in the Agricultural Colleges," Mr. Shepardson makes an earnest plea for individual initiative and leadership on the part of some of these institutions. One may find it difficult to accept as significant his differentiation as to objectives between type A (university colleges) and type B (separate institutions), but there can be little reason to question his conclusion that "there is no reason in the nature of things why agricultural research of the highest order and graduate training second to none can not be achieved and maintained in at least a part of these institutions," and that the example set by an active and constructive leadership by one of the land-grant colleges "in any field or at any level" is "quick and strong." As he truly states, these considerations "throw responsibility for the development of fundamental science and research in agriculture, for the betterment of graduate training, and for the achievement of all that is implied in the elusive word 'university,' squarely on the shoulders of the State institutions." Likewise, as he concludes, "if it is a great responsibility, it is also a great opportunity."

Mr. Shepardson's little book makes no claim to being exhaustive or to carry with it the weight of authority, but it contains much to stimulate thought and provide a basis for discussion. Perhaps it is most significant because of its unique and independent viewpoint. There have been numerous histories of agricultural education and multitudinous discussions of agricultural problems and objectives, but only rarely are we told so frankly and yet so sympathetically what impressions the land-grant colleges are really making on what may be termed the "nonagricultural public." It should be a matter of encouragement and congratulation that a representative of this class finds after an extended survey so much to commend, that he appreciates so adequately the importance of higher educational standards, and that he evaluates so accurately as the very foundation of the structure the strengthening of research.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Recent advances in biochemistry, J. FEYDE (*Philadelphia: P. Blakiston's Son & Co., 1928, 2. ed., pp. X+379, [pls. 4], figs. [34].*)—This is a second edition of the work previously noted (*E. S. R., 56, p. 309*).

The colloid chemistry of protoplasm, L. V. HEILBRUNN (*Berlin: Borntraeger Bros., 1928, pp. VII+356, figs. 15.*)—The author's viewpoint is well indicated in the concluding paragraph of the first introductory chapter of this monograph:

"The colloidal study of protoplasm is not easy. Observations must be made on tiny droplets of a material incompletely defined from a chemical standpoint, and probably consisting of a mixture of highly complex compounds. The results that can be gained with such material must be regarded leniently. . . . But one must not be too lenient. If the colloid chemistry of protoplasm is to be a science, it must be based on firm facts and not on subjective impressions. . . . An attempt will be made to present the facts as they are now known. Few as these facts are, they show that a rational science of the colloid chemistry of protoplasm is possible, and that it is now in the making."

The aspects of the subject in the discussion of which this viewpoint is developed include, among others, methods of study, the morphology and the chemistry of protoplasm in a general view, its absolute viscosity, its elasticity, its electric charges, and its activity, both general and divisional; and the actions of salts, acids, alkalis, and fat solvents, of changes of temperature and of other physical factors.

Chemistry of the enzymes.—I, General chemistry of the enzymes, H. von EULER (*Chemie der Enzyme.—I, Allgemeine Chemie der Enzyme. Munich: J. F. Bergmann, 1925, 3. ed., rev., pt. 1, pp. [XI]+422, pl. 1, figs. 50.*)—The third edition of this work, divided at the time of its second edition (*E. S. R., 46, p. 9*) into two parts, is now to appear in three volumes, of which the first is here noted. Save for expansion and revision to keep pace with the broadening and advance of experimental knowledge in its field, this first or general part appears little altered in general plan.

Enzyme actions and properties, E. WALDSCHMIDT-LEITZ, trans. and ext. by R. P. WALTON (*New York: John Wiley & Sons; London: Chapman & Hall, 1929, pp. XVIII+255, figs. 12.*)—This is a translation of the German edition already noted (*E. S. R., 57, p. 203*), but "the original German text has been considerably extended, although the additions have been principally from the viewpoint of the Willstätter school. The purpose of the modifications has been primarily to bring the context of the volume up to the present date rather than to impose any particular viewpoint of the translator. This revision and extension has been carried out with the cooperation of the author."

Mechanism of enzyme action and associated cell phenomena, F. F. NORD (*Baltimore: Williams & Wilkins Co., 1929, pp. IX+78, figs. 7.*)—The discussion presented in this short monograph is distributed under the following captions:

Introduction; the rôle of zymophosphates; the co-enzyme; a theory to interpret the so-called "activation"; the conversion of sugars into compounds of the three carbon chain series; the intermediate products; conclusions—investigations based on the hydrolytic splitting of bound sulfurous acid and the reaction between different aldehydes; reductions and syntheses in the course of sugar dissimilation; and transformations through other microorganisms. A bibliography of 189 items concludes the work.

Salts, acids, and bases; electrolytes; stereochemistry, P. WALDEN (*New York and London: McGraw-Hill Book Co., 1929, pp. [9]+397, pl. 1, figs. 26*).—The book consists of a series of lectures which, following an introductory discussion of the topic, What can the modern chemist learn from the old alchemy? is presented in four parts. The first of these, salts, acids, and bases, has these chapters: Historical development of the concepts, and summary of the development of the chemical views concerning salts, acids, and bases. The second part, electrolytes and nonelectrolytes, takes up electricity and matter, What is an electrolyte? Daniell's researches (new kinds of ions and constitution of electrolytes), and the latest phase in the development of the concept "acid-base." The third part, electrical conductivity of nonaqueous solutions, includes "strong" and "weak" electrolytes from the standpoint of aqueous solutions; conductivity curves of nonaqueous salt solutions in accordance with the square-root law; numerical data of conductivity and degree of dissociation in water, methyl and ethyl alcohols, and acetone; Do typical binary salts which are found to be equally strong in equivalent aqueous solutions retain this same relationship in nonaqueous solutions? so-called "nonconductors" as ionizing agents for typical binary salts; and regularities in maximal conductivities and ion mobilities in nonaqueous solvents. Part 4, stereochemistry and optical (Walden) inversion, is subdivided into early history of stereochemistry and optical inversion phenomena (Walden inversion). Subject and author indexes are appended.

Purification and preservation of ether for anesthetic use, S. PALKIN and H. R. WATKINS (*Indus. and Engin. Chem., 21 (1929), No. 9, pp. 863-867*).—This contribution from the Food, Drug, and Insecticide Administration, U. S. D. A., describes two reagents for the purification and preservation of ether. Either preservative kept the purified ether free from aldehydes and peroxide during storage of more than a year, the samples having been exposed throughout this period both to light and to relatively high temperatures.

For purifying the ether, distillation either from strongly alkaline permanganate or from strongly alkaline pyrogallol, the reagent being taken up in asbestos in either case, followed by the passing of the condensate in the form of a fine spray through columns of strongly alkaline solutions of either of the agents proved effective; and preservation, even under the rather severe test conditions above noted, was effected without any contamination of the product with the preserving agent by storing the ether in contact with either form of the asbestos-absorbed preservative. Poured off without filtration from either preservative, the ether showed neither aldehyde and peroxide contamination nor excess of nonvolatile residue.

Investigations on pectin substances and their breakdown by enzymes, A. C. SLOEP (*Onderzoekingen over Pectinestoffen en Hare Enzymatische Ontleding. Proefschr., Tech. Hoogeschr., Delft, 1928, pp. 161, pls. 5, figs. 9*).—Following a brief introduction, this dissertation presents a review of preceding investigations on the chemistry of the pectin substances; earlier work on the localization of the pectins and on the manner of their occurrence in the plant; the present situation with regard to the question of the chemical con-

stitution of the pectins; analytical methods adapted to the chemical investigation of pectins; the preparation and analysis of pectins from citrus skins; earlier investigations on pectase; some observations on the action of pectase on pectin preparations; preceding investigations of protopectinase and pectinase; investigations on the presence and significance of protopectinase and pectinase; and a summary of the results, in which are discussed the experimental findings in general.

Reagents and culture media, E. BÖHM and K. R. DIETRICH (*Reagenzien und Nährböden*. Berlin and Vienna: Urban & Schwarzenberg, 1927, pp. VII+375).—The book is primarily a formulary, little or nothing being added to the statements of the names and quantities of components save condensed directions essential to the preparation of the required solution, reagent, or mixture.

The formulas listed are comprised in the following categories: (1) Reagents for qualitative tests, (2) reagents for quantitative analysis, (3) reagents for physiological-chemical investigations, (4) reagents for microscopic (bacteriological, botanical, histological, zoological, etc.) investigations, (5) culture media, (6) preservative solutions, and (7) a collection of formulas for solutions for the cleaning, labeling, and sealing of vessels, for the charging of cells, for freezing mixtures, and the like. An appendix gives various equations for calculations, tables of physical and chemical data, etc.

Bacteriological culture medium technic, F. KAHLFELD and A. WAHLICH (*Bakteriologische Nährboden-Technik*. Berlin: H. Kornfeld, 1929, 2. rev. ed., pp. XIV+167, figs. 66).—In addition to the account of the general and special culture media, liquid and solid, the book contains chapters on staining solutions and mordants, on the embedding of tissues in paraffin and in celloidin, and the method of freezing into anise oil, with which is included a brief statement of some procedures for fixing, hardening, and dehydrating tissues in preparation for the use of embedding methods, a general account of other methods used in the bacteriological laboratory, and a final chapter outlining the construction, purposes, and methods of use of the more important apparatus such as sterilizers, incubators, thermoregulators, and various types of centrifugal apparatus.

A comparison of the colorimetric and potentiometric methods for hydrogen ion determinations in solid bacterial media, M. W. LISSE (*Pennsylvania Sta. Bul.* 243, p. 6).—The use of a method based on the buffer equation and the observation of a buffering power in nutrient agar sufficient to permit of a sevenfold dilution without change in the pH value is reported. It is noted that at the dilution named the medium remains liquid, permitting the use of potentiometric pH measurements.

The applicability of the quinhydrone electrode was also studied, with attention to the elimination of the effect of the drift of potential of the quinhydrone electrode "by extrapolation of the values observed at successive intervals of time to zero time." The average results of 60 parallel determinations were taken to indicate a value for the quinhydrone electrode measurement 0.15 pH unit lower than that obtained from the hydrogen electrode, "which in turn agrees well with the indicator method, using bromothymol blue as an indicator."

Biological stains, H. J. CONN (*Geneva, N. Y.: Conn. Standardization Biol. Stains*, 1929, 2. ed., enl. and rev., pp. 224, figs. 5).—In the addition of the newer material, the first edition (E. S. R., 54, p. 503) of this handbook has been almost entirely rewritten, W. C. Holmes and R. W. French collaborating. In addition to the inclusion in the present edition of a larger number of dyes which find application as biological stains, there have been incorporated also

in connection with the general statements concerning a number of the more important stains, many of the most widely used formulae and procedures for their use.

The determination of nitrogen in yeast at sugar sirup [trans. title], M. S. ФИЛОСОВ (Nauch. Zap. [Inst. Sakh. Promysh., Kiev]. 7 (1928), No. 5, pp. 185-187, figs. 2).—The author describes a method whereby the ammonia from the material is directly distilled over without previously digesting with sodium sulfate. A sample of from 0.3 to 0.5 gm. of the substance is mixed with 1 gm. of caustic soda and 2 gm. of sodium acetate, and placed in a copper tube 18 cm. long and 2.5 cm. in diameter. A tube leading from the copper tube to an adapter is immersed into standard acid. The 18-cm. tube is gradually heated and within 20 minutes the reaction is completed. The apparatus is illustrated.

Spices, compiled by M. T. READ (U. S. Dept. Agr., Bur. Chem. Digest 1 (1927), pp. 37+X).—A mimeographed bibliographical summary of the work of the Bureau of Chemistry covering the period 1887-1927. A brief abstract accompanies each title.

Fruits and fruit products, compiled by M. T. READ (U. S. Dept. Agr., Food, Drug, and Insecticide Admin. Digest 2 (1929), pp. 112).—A summary corresponding to the above of the work of the Bureau of Chemistry and the Food, Drug, and Insecticide Administration from 1862 to 1928.

Investigations on the relations between the acidity and freezing point of milk, A. J. PARKER and L. S. SPACKMAN (Analyst, 54 (1929), No. 637, pp. 217-223, figs. 3).—Series of freezing point determinations upon milk samples allowed to become increasingly acid led the authors to the opinion that 0.20 per cent acidity as lactic acid, given by Bailey (E. S. R., 50, p. 112) as the normal acidity for fresh milk, is too high a figure. A value of 0.14 per cent is suggested as being nearer the truth.

The correction factor of 0.003° C. for each 0.01 per cent of acidity in excess of 0.20 was found by the authors of the present paper to hold from 0.17 to 0.60 per cent acidity. For acidities ranging from 0.14 to 0.17 per cent the value 0.010° is suggested.

When watered milks of known percentage of adulteration were examined, the results indicated that the cryoscopic determination of the added water can be regarded as accurate only when the samples are quite fresh.

The cryoscopic method for the detection of added water in milk, R. L. ANDREW (Analyst, 54 (1929), No. 637, pp. 210-216).—From an experience with the cryoscopic method described as covering a period of more than 17 years and including the carrying out of a large number of determinations, the author concludes that the freezing point of unwatered milk may be taken as not higher than -0.550° C. If the sample freezes at -0.530° or above, watering is to be suspected, and if the freezing point is as high as -0.520° "the milk has certainly been adulterated with approximately 5 per cent of added water."

As advantages of the cryoscopic test the author finds that "it provides a simple and reliable means of detecting added water in milk. It makes possible the prevention of the practice of adding sufficient water to rich milk to bring the solids-not-fat down to the legal standard. It provides a means of distinguishing between naturally poor milk and milk to which water has been added."

The refractometer in milk analysis, G. D. ELSDON and J. R. STUBBS (Jour. Soc. Chem. Indus., Chem. and Indus., 47 (1928), No. 44, pp. 1145, 1146).—As a result of the examination of some 8,000 milk samples the authors consider it demonstrated that, while the refractometer can be used for the detection of added water in milk, its indications are no more reliable than are those of

the nonfatty solids figure. This is on account of the variations, which may be quite equal to those of the percentage of solids-not-fat, in the refractive indices of unadulterated milks.

In general, the refractive indices and the percentages of solids-not-fat rose or fell together; the test was found useless for any but fresh milks; and naturally poor milks were found to give results in the refractometer appreciably different from those yielded by unadulterated milks of a better quality.

Methods of blood analysis, A. K. ANDERSON and H. E. HONEYWELL (*Pennsylvania Sta. Bul.* 243 (1929), p. 6).—The development of a method permitting the determination of the nonprotein blood nitrogen in 0.1 cc. of the sample is reported. With the use of this procedure venous and capillary blood samples gave the same values for nonprotein nitrogen.

The figures chlorides as sodium chloride 515.18 mg., uric acid 2.5 mg., and urea nitrogen 15.58 mg. in 100 cc. are given as the average results of analyses of 11 samples of normal rat blood.

METEOROLOGY

The present status and outlook of agricultural meteorology [trans. title], A. KALGORODOFF (*Mct. Ztschr. [Brunswick]*, 46 (1929), No. 10, pp. 399, 400).—The present status and the outlook of agricultural meteorology are briefly summed up in 12 theses, which emphasize especially the importance of more intensive study of meteorological conditions immediately surrounding cultivated plants, including light as well as temperature and moisture; studies under controlled conditions which make possible the more exact evaluation of the effect of the different factors; and coordination of the work of the meteorologist with that of the chemist, the physiological botanist, and others.

How far can man control his climate? R. DEC. WARD (*Sci. Mo.*, 30 (1930), No. 1, pp. 5-18).—Reviewing various measures which have been proposed or used for the artificial control of or protection against weather and climate, such as lightning and frost protection, "hail shooting," prevention and dispersal of fog, artificial production of rain, and utilization of forests and wind-breaks, the author states that "we can, here and there, by methods developed as the result of experience and of study, protect ourselves against or prevent the occurrence of certain conditions which are disagreeable or dangerous to us, or are injurious to our crops. We can not produce rain, or change the order of nature. But where we have succeeded, as in frost prevention, for example, the results are of very great economic significance. That the future will bring further advances in the way of controlling local climates is certain. There is no hope, however, of our ever being able to bring about any but local modifications."

Influence of plant cover (winter wheat) on the temperature of the surface soil and the temperature and moisture of the air [trans. title], A. KAMENEVA (KAMENEF) (*Zap. Leningrad. Selsk. Khoz. Inst. (Mém. Inst. Agron. Leningrad)*, 5 (1929), No. 5, pp. 43-75; *Ger. abs.*, pp. 74, 75).—Observations are reported which showed that the temperature of the surface soil was lower under wheat than under bare fallow. The temperature of the air immediately above the soil was influenced by the plant cover, but in varying degree, depending upon the time of day, wind, and other factors. The plant cover increased the moisture of the air.

Relative humidity and forest fires, D. R. BERGSMARK (*Ill. State Acad. Sci. Trans.*, 20 (1927), pp. 238-246).—This is a review of studies on the relation of humidity to forest fires, with a list of 25 references to the literature of the

subject. Practical applications of the humidity records in forest fire control are made.

Agricultural ecology, G. AZZI (*Ecologia Agraria*. Turin: Unione Tipog.-Editrice Torinese, 1928, pp. 237, pl. 1, figs. 95).—This treatise is the second part of the New Italian Encyclopedia of Agriculture (Nuova Enciclopedia Agraria Italiana) and deals with the subject under the following heads: (1) Fundamental concepts of agricultural ecology, (2) atmospheric environmental factors, (3) genetics and ecology, (4) ecological problems of special crops, (5) agricultural ecology in relation to other agronomic requirements, and (6) organization of research in agricultural ecology.

Meteorology, C. O. CROMER ET AL. (*Pennsylvania Sta. Bul.* 243 (1929), pp. 35, 36).—Observations at State College, Pa., on temperature, precipitation, and cloudiness for the year 1928 are summarized, showing that the average annual monthly mean temperature was 49.2–1.2° higher than the normal. The highest temperature was 91° F. July 9 and August 3, the lowest –3° January 30. The precipitation for the year was 39.43 in.—1.16 in. below the normal.

British floods and droughts, C. E. P. BROOKS and J. GLASSPOOLE (*London. Ernest Benn*, 1928, pp. 199, pls. 2, figs. 15).—This book, with an introductory note by H. R. Mill, reviews rainfall of the British Isles; great rains, floods, and droughts in ancient and modern times; and variations of rainfall. The subjects of the different chapters are: The cause of persistent rain; the wet year 1927—the turn of the tide?; the wet summer of 1924: 1903—the year with two wet spells; the rainy seasons of the seventies; historic rains; the Thames flood of 1928 and other floods; the causes of drought; the drought of 1921; the dry year 1887; dry years of the eighteenth century; historic droughts of the middle ages; extremes of rainfall; and cycles of weather. With regard to rainfall periodicities or recurrences, it is stated that “they do not amount to a great deal” in Great Britain as a basis for reliable forecasts. “They are not only small in comparison with the accidental or irregular variations; they are not even entirely regular and permanent, but have an unfortunate tendency to break down at critical moments and to start again at the wrong time.”

SOILS—FERTILIZERS

[Soils investigations 1928–29] (*Illinois Sta. Rpt.* 1929, pp. 8–29, 31, 32, 54, 55, figs. 2).—A number of studies are reported.

Drainage water studies reveal interesting facts.—The drainage of nitrogen, sulfur, calcium, magnesium, and potassium from lysimeters cropped to soybeans in 1924 and to corn in 1925 is tabulated, both summer and winter figures being given. There was observed a comparatively slight loss of all of the elements determined during the growth of the corn as compared with the loss during the preceding season from under the soybeans. “This is to be explained partly by the very small amount of drainage water coming through in the second season. . . . However, the low drainage was the result not only of the low rainfall of that year, but also of the higher utilization of transpiration water by the corn crop.” The work is attributed to E. E. De Turk and V. E. Spencer.

Great improvement possible in Illinois soils.—Under this head are discussed and tabulated the yields from untreated lands and the net returns from the best soil treatments as observed in a large number of fields. The predominating soil type is noted in each case, and the most profitable treatment both in the livestock system and the grain system is included among the data tabulated.

“Man and nature” relationships shown by old plots.—“With better cropping, the influence of nature decreases and that of man increases. Where a good

3-year rotation including clover was used, nature was responsible for about one-third of the harvest and man for two-thirds of it. . . . On the basis of net returns, the soil treatment consisting of manure, limestone, and phosphate was least effective when corn was grown continuously and most effective in the 3-year rotation with clover. In fact this treatment was three times as effective in the 3-year rotation as it was in the single-crop plan of cropping. These data emphasize the great importance of giving careful attention to management practices in crop production."

This work is credited to F. C. Bauer and H. J. Snider.

Wheat crop to finish two-year rotation test.—Pot experiment results obtained by R. S. Smith in a test of a wheat-sweetclover rotation, with wheat straw and sweetclover as sources of organic matter, and mineral soil treatments with limestone, potassium salts, superphosphate, rock phosphate, and gypsum, are very briefly noted.

Study fertility plans for grain and stock farming.—Comparison of the grain system with the livestock system was made by Bauer and Snider on 15 experiment fields on dark-colored soils, on 10 fields on light-colored soils, and on one field of sandy soil, under the three conditions of no mineral treatment, application of limestone, and treatment with both limestone and phosphate. The results are stated in the form of a table of the average annual increases in the money value of the crop from the rotation ending with the year 1928. In general, the greatest gains appear in the figures from the lime and phosphate treatment in the livestock system.

Corn yields increased 12 bu. by residues.—Experiments similar to those indicated under the preceding caption and carried out by the same investigator demonstrated the high relative value of legumes as residue crops for this type of soil treatment. Clovers used in part as crop residues for soil improvement showed a considerable value, whereas residues not including those of legume crops were of very little value. The results of the experiments are stated as bushel increases in yield of corn, oats, and wheat and as average annual acre values of the total grain crop increases and of the total increases of all crops.

Ton of manure worth more on poor soils than on good.—Data are tabulated, based on the work of Bauer and Snider.

Underlying facts worked out on use of limestone.—The statements noted very briefly summarize some results of an investigation by DeTurk and R. H. Bray of the interaction of limestone and acid soils. Applications of 2.5 and 5 tons of crushed limestone, standardized carefully with regard to fineness, were given a highly acid soil in 1923, and the changes induced were followed throughout the succeeding five years.

"The limestone, in proportion to the amounts applied, has in the first place increased the degree of saturation of the base-absorbing capacity of the soil from 20.7 per cent saturated in the unlimed soil to 49.6 per cent with a 2.5-ton addition, and to 71.9 per cent where 5 tons were applied. Most of the added limestone may be accounted for either in this absorbed condition, where it continues to fulfill its valuable functions, or in undecomposed calcium carbonate. Only 10 to 13 per cent is not thus accounted for. It has either been removed in harvested crops or drainage water, or converted in the soil into comparatively insoluble and unavailable mineral form. While aiding to satisfy the base-capacity, this limestone is also keeping down the active acidity of the soil. The acidity of the untreated soil corresponds to a pH value of 4.3. The light limestone has raised this value to 5.2, while the 5 tons have nearly neutralized the soil, bringing the pH value to 6.4."

Limestone worth \$34 a ton on light-colored soils.—Work of Bauer and Snider on crop increases obtainable by the use of limestone on each of 26 fields is

briefly discussed, the numerical results being reported as annual acre value of the stated application of limestone, with the approximate ton values for both the grain system and the livestock system.

Rock phosphate worth most in grain farming.—Results by Bauer and Snider on 27 experiment fields are tabulated.

Find little difference in two forms of phosphorus.—According to the tabulated results of DeTurk and J. C. Anderson, rock phosphate with gypsum was superior to superphosphate supplying the same quantities both of phosphorus and of sulfur in the treatment of corn, but not for wheat, oats, barley, or soybeans.

Turn to soil itself in study of phosphates.—Apparently very similar samples of brown silt loam from Livingston and from Macoupin Counties, respectively, responded entirely differently to phosphate treatment, that from the first-named county showing, in a pot test conducted by DeTurk and Smith, a very marked response in the early growth of wheat both to superphosphate and to rock phosphate, whereas the second sample gave responses in wheat growth with neither form of phosphate.

Potash proves itself worth \$91 a ton at Ewing.—Bauer and Snider found potassic fertilizers used in conjunction with limestone, rock phosphate, sweetclover, and a good rotation to be profitable on the light-colored soils in most instances. It is noted, however, that on the dark soils the use of potassic fertilizers was generally not profitable.

Other fertilizer treatments overshadow sulfur.—Thorough trials given gypsum (9 years on one field and 5 years at 4 others) led to the conclusion by Bauer and Snider, in charge of the experiment, that the treatment is not of significant value in any of the fields. Only on the light-colored soils could any influence at all be demonstrated.

Sweetclover adds 12 bu. to corn yield.—In work by Bauer and Snider, where red clover could be grown in favorable seasons without limestone the crop residue treatment added 5 bu. to the corn yield, but on lands on which neither red clover nor sweetclover could be grown without limestone the crop residues added only 3.4 bu. to the corn yield. Limestone with crop residues (sweetclover included in each case) gave increases of from 14.8 to 17.9 bu.

Measure fertility value in soybean plant.—The nitrogen contents of the roots, stems, leaves, pods, and seeds of the soybean plant as determined in the work of Bauer and DeTurk on the fertility value of the residues of this crop are given for plants in the green, in the nearly matured, and in the fully matured state. An accumulation of the nitrogen supply of the plant in its seeds is indicated in the analyses of the two last-named stages. The contrast of this behavior of the soybean with the accumulation of nitrogen in the roots of the maturing sweetclover, as noted in a previous report (E. S. R., 58, p. 316), is pointed out.

Probe secret of sweetclover's soil-building power.—Having found that succeeding corn crops were as much benefited by sweetclover plowed under in the early spring as by a more prolonged growth of sweetclover, and that the removal of a hay crop, leading to a comparatively small spring top growth of the clover, had no ill effect upon the subsequent corn yield, O. H. Sears et al. made greenhouse trials of the effect upon soils low in organic matter of the removal of both tops and roots of the sweetclover, with the result that the crop-producing power of the soil was found to have been improved by the mere growing of the sweetclover crop in the soil. This result was again obtained when the experiment was repeated in the field. In both cases, however, a greater improvement was secured by the plowing under of the clover on the land upon which it had been grown, although the addition of harvested

sweetclover to soil upon which this crop had not been grown did not give as good a result as did the growing and subsequent entire removal of the clover. Nitrate determinations indicated that a sweetclover crop plowed under furnished available nitrogen in excess of the demands of the succeeding crop.

Measure straw's effect upon soil's producing power.—The application of 2 tons of straw was shown by Sears in a study of the effects of crop residues upon the crop-producing power of soils to reduce the corn yield in one case by 88 per cent, the plowing under of sweetclover lessening this setback to 34 per cent. On a soil classed as "alkali" land, and found to have an excessive nitrate concentration, the straw treatment increased the corn yield 132 per cent, however, the effect being attributed in this instance to the combined benefits of a reduction of the excessive nitrate concentration and the supplying of available potassium provided by the straw.

[Soil fertility studies of the Indiana Station], A. T. WIANCKO ET AL. (*Indiana Sta. Soil Fertility Invest., Scottsburg Field, 1910-1928, pp. 4; Worthington Field, 1913-1928, pp. 4; Francisco Field, 1917-1928, pp. 4; Pimncy-Purdue Field, 1920-1928, pp. 7; Jennings Co. Field, 1921-1927 and 1921-1928, pp. 8 each, fig. 1 each; Soils and Crops Expt. Farm, 1915-1926 and 1915-1928, pp. 12 each, figs. 2 each*).—Further results of the fertilizer tests previously noted (E. S. R., 57, p. 714) are here reported, with recommendations in each case as to the treatment of the soil represented.

Soil survey of Salem area, New Jersey, R. T. A. BURKE ET AL. (U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.], Ser. 1923, No. 47, pp. 1649-1696, fig. 1, map 1).—The Salem area, a tract of 337,280 acres inclusive of parts of three New Jersey counties, is located in the southwestern section of the State, and varies in surface from flat to steeply rolling. The Delaware River provides but a "fairly well developed" drainage system.

Tidal marsh (including 6.9 per cent in reclaimed areas) and swamp constitute 22.3 per cent of the area, followed in order of areal importance by Sassafras sandy loam 13 per cent, Sassafras loam 11.6 per cent, and 30 other types grouped in 11 series, with 2.4 per cent of meadow.

The survey was made in cooperation with the New Jersey Department of Conservation and Development.

The influence of the reactions of the sub-soil upon the growth and root development of alfalfa, H. N. WATENPAUGH (Pennsylvania Sta. Bul. 243 (1929), pp. 10-12, figs. 2).—The experiment was made upon Dekalb silt loam surface soil placed in large sewer tiles sunk in the ground. "Results for the first year show a very marked difference in the growth of alfalfa roots in the different soil horizons. Soil with the lime requirement just met, according to the exchangeable hydrogen method (1,000 lbs. per 1,000,000 lbs. soil), seems to give best root development even though this amount of lime does not completely neutralize the soil acidity. There are indications that an excess of lime is detrimental to root development and the production of alfalfa. Correlations between root development, pH value, and replaceable calcium are quite definite. Replaceable calcium and H-ion concentration determinations upon the tile and upon field samples indicate that additions of lime to the upper horizons or the surface soil gradually 'sweeten' the lower horizons or the subsoil."

Soils studies: Green manure project, R. W. RUPRECHT (Florida Sta. Rpt. 1928, p. 34).—Crops plowed under for organic matter were shown by lysimeter tests to cause a loss of plant food in the leachings greater, if no crop was grown immediately following the plowing, than from the soils upon which no green manure crop had been grown. One year after the plowing under of

fresh organic matter in Norfolk sandy loam no appreciable increase over the original carbon content and no increase in the nitrogen content of the soil could be demonstrated.

The effects of lime on the old general fertilizer plots, C. F. NOLL (*Pennsylvania Sta. Bul.* 243 (1929), pp. 9, 10).—Of the various miscellaneous results here reported the most striking is that of a comparison of limed and unlimed plats treated biennially with 24, 48, and 72 lbs., respectively, of nitrogen in the form of ammonium sulfate. The relative yields here reported are 82, 34, and 20 without lime and 132, 129, and 124 after liming, 100 representing the yield from an unlimed plat receiving phosphatic and potassic fertilizers only.

AGRICULTURAL BOTANY

A study on certain germinating conditions of *Nicotiana* seeds [trans. title], V. K. KRAPIVINA (KRAPIVINE) (*Trudy Detskosl'sk. Akklim. Sta. Leningrad. Selsk. Khoz. Inst. (Bul. Sta. Acclim. Leningrad Agr. Inst., Detskoje Selo)*, No. 7 (1928), pp. 181-187, figs. 3; *Eng. abs.*, pp. 186, 187).—This preliminary investigation was carried out in 1925 at the Station of Acclimatization at Detskoye Selo regarding the influence of light, darkness, and a snow cover on the germinating power in the seeds of two varieties of *N. tabacum* and of two varieties of *N. rustica*. From each variety two samples of the same age were used, the first lot being kept in darkness and the second exposed to light. At the close, computation was made of the heat used up in sprouting and the germination percentage. The results, as tabulated, show an adverse influence of light as regards germination and growth vigor in the case of *N. rustica* and a favorable effect of light on both varieties of *N. tabacum*.

Germination in complete darkness at the optimum temperature of from 28 to 32° C. was lower than in experiments in darkness at a suboptimum temperature.

Tests to verify the supposition regarding an advantage from customary seeding of these tobaccos under snow at the station showed that after keeping the seeds for 10 days under from 10 to 15 in. of snow a stimulating effect had been produced on germination, but no acceleration was apparent.

Influence of H-ion concentration on the development and growth of buckwheat [trans. title], L. S. KACHIONI-VALTER (KATCHIONI-WALTHER) (*Trudy Detskosl'sk. Akklim. Sta. [Leningrad. Selsk. Khoz. Inst.] (Bul. Sta. Plant Acclim. Detskoje Selo)*, No. 5 (1927), pp. 73-96, figs. 10; *Eng. abs.*, pp. 95, 96).—During experimentation carried out by the method of water culture at the physiological department of the Station for Plant Acclimatization at Detskoye Selo in the summer of 1924, it was sought in the first series, using Shive's nutrient solution at 0.9 atmosphere, to ascertain the influence of pH at points 4.5, 5.0, 5.5, 6.0, 7.0, 8.0, and 9.0 on the development and growth of buckwheat; in the second, the influence of Shive's solution at 1.75, 0.9, and 0.4 atmospheres and Knop's at 0.9 atmosphere; and, in the third, to repeat the first on the influence of pH, but using Knop's nutrient solution, cultivating at pH 4.5, 5.0, 5.5, and 6.0, some plants with the chlorine ion and some without. The reaction of the medium was adjusted with HCl and NaOH, the pH being determined by the colorimetric method with Clark's indicators. The reaction changes were determined daily and pH restored, the solutions being changed weekly.

Buckwheat proved to be very sensitive to H from its first development stage. At the points 5.0, 5.5, 6.0, and 6.5 the pH was favorable to the development of buckwheat under the experimental conditions in the presence of the chlorine

ion. The pH at points 7.0, 8.0, and 9.0 was injurious to growth. At pH 4.5 neither advantage nor injury was noticeable.

For buckwheat Knop's solution was the more favorable solution, and Shive's at 0.45 atmosphere the least favorable. The influence of the chlorine ion was very marked, depending on the pH. In the absence of the chlorine ion the optimal range diminished, centering near pH 6.0.

On biology of rye.—Interchange of gases in the vegetative organs of rye at different stages of development [trans. title]. N. I. SOKOVINA (*Nauch. Agron. Zhur. (Jour. Landw. Wiss.)*, 5 (1928), No. 7-8, pp. 515-527, figs. 2; *Eng. abs.*, pp. 526, 527).—As a result of studies described involving gas analyses, it is claimed that, when the rye plant has its first three leaves, assimilation is greatest in the first one, evaporation in the second, and respiration in the third. In this stage, the rye plant at a temperature below +5° C. (41° F.) exhales more carbon dioxide in light than in darkness. During the stage of stooling, the lowest leaf leads in assimilation. In the blooming and in the ripening stage, intensity of assimilation is shown in decreasing order by the leaf lamina of the fifth upper internode, that of the fourth, then the stem of the fifth internode, that of the fourth, the leaf sheath of the fourth internode, and the ear. Intensity of evaporation diminishes in the same order. As regards respiration intensity, the order is that of the leaf lamina of the fourth internode, that of the fifth, the ear, the stem of the fifth internode, the leaf sheath of the fifth, the stem of the fourth, and the leaf sheath of the fourth.

A certain correlation is observable in the assimilatory activity of the parts, such that the plant decomposes, for unit time and weight, the same quantity of carbon dioxide despite the great fluctuations in carbon dioxide decomposition observable in particular parts of the plant. The same appears to be true with regard to respiration.

Interchanges between plant and culture solution in tobacco and maize [trans. title], T. DEMIDENKO (*Nauch. Agron. Zhur. (Jour. Landw. Wiss.)*, 5 (1928), No. 7-8, pp. 528-540; *Ger. abs.*, pp. 538, 539).—In cultures with renewal of solutions, tobacco and maize during their vegetative period give out more organic compounds than in cultures not renewed. Tobacco produces on the basis of dry matter more root excretion than does maize. The appearance of organic materials among plants in the earlier stages, while supposedly only growth of the roots, and not root excretion, is going on, is explainable on the basis of differences in the concentration of these substances inside and outside the cell. Tobacco and maize give off their organic compounds in large quantities up to the time when the assimilation processes within them reach their maximum, and the cells, it appears, give up part of their assimilates into the external solution. As they age, the roots gradually decrease the amount of their exosmosis.

The phenomena observable in sterile water cultures and in water-sand cultures is described, with details as to differences due to the presence of organisms, as *Azotobacter chroococcum* and *Clostridium pasteurianum*.

The rôle of magnesium in the aging of plants, B. F. LUTMAN and N. L. WALBRIDGE (*Vermont Sta. Bul.* 296 (1929), pp. 48, pls. 4, figs. 3).—Following a general account of recent studies on senescence in plants, the authors report on investigations with the potato and millet to determine the effects of minimum doses of magnesium and also of nitrogen and phosphorus on the aging and yellowing of foliage, and reach the general conclusion that lack of magnesium probably plays only a secondary part in senescence, leading to early chlorosis rather than aging.

Japanese millet plants grown with a minimum of magnesium contained only about 25 per cent as much magnesium as did similar plants grown with abun-

dant magnesium. The magnesium-deficient plants developed few leaves, the lower ones becoming yellow from lack of chlorophyll and the upper ones showing only traces of chlorophyll.

Potato plants in sand cultures without magnesium were able to produce tubers and vegetation which contained only a small percentage of magnesium as compared to normal plants. Analyses of potato plants grown in the field showed an increase in the percentage of magnesium in the ash during the growing season, with the ash of the young leaves always highest. However, only about 10 per cent of the magnesium was located in the chlorophyll.

A histological study of potato leaves from low magnesium plants showed no reduction in the size of cells, nuclei, nucleoles, or chloroplasts, but in millet there was a reduction in the size and number of the chlorophyll bodies in leaves of no magnesium plants. The magnesium needs of plants are considered very small and normally well supplied from the soil, being rarely a limiting factor in growth.

A contribution on the significance of photoperiods with *Nicotiana tabacum* [trans. title]. V. K. KRAPIVINA (KRAPIVINE) (*Trudy Detskosl'sk. Akklim. Sta. Leningrad. Sel'sk. Khoz. Inst. (Bul. Sta. Acclim. Leningrad Agr. Inst., Detskoje Selo), No. 7 (1928), pp. 188-198, figs. 2; Eng. abs., pp. 197, 198.*)—In the *N. tabacum* variety Dubeck, determined previously as a long-day plant, a shortening of the period of illumination from the whole daylight period gave as a result a lessening of development, progressive with continued shortening of the light period. After being restored to normal daylight conditions, the plants required from 5 to 10 days to regain their normal development and size.

In another experiment (testing a reversal of treatments), after *N. tabacum* variety Dubeck had been kept for some time under the conditions of normally long daylight, the plants were subjected to a shortening of the daily period. No stimulating effect was apparent (in the final results) from keeping these plants under normal and then decreased daylight alternately. The longer the subjection of the plant to shortened daylight was kept up, the more pronounced became its hindering effect on growth. Comparison shows that there was a sharper reaction to decrease from normal daylight when this decrease of light periods was brought to bear in the later stages of growth.

The effect of irradiation on the electrokinetic potential, agglutinability, lysis, and pH of *Escherichia coli*, and a comparison of results obtained with the Northrup Kunitz cell and the Falk capillary cell, M. W. LISSE, G. R. SHARPLESS, and R. P. TITSLER (*Pennsylvania Sta. Bul. 243 (1929), pp. 6, 20.*)—Both maximum and actual values of electrophoretic velocities indicated initial stimulation accompanied by an increase in charge and later destruction accompanied by a decrease. Short-time irradiation was followed by a return toward normal. A decrease in charge was accompanied by an increase in agglutinability, lysis, death, and an increase in pH. Electrophoretic studies appeared more sensitive than agglutination studies as a measure of the effect of irradiation. Evidence was secured that Mazda lamplight acts similarly if the irradiation is carried on long enough. Both of the cells employed proved suitable for electrophoresis studies.

Observations upon the alfalfa root-nodule-forming organisms indicated that differences in electrophoretic measurements are associated with differences in nitrogen-fixing ability.

Starchlike radiate crystals produced by *Bacterium marginatum* in starch media, L. MCCULLOCH (*Jour. Agr. Research [U. S.], 39 (1929), No. 7, pp. 495-501, figs. 2.*)—*B. marginatum*, a plant pathogene causing a destructive disease on the leaves and corms of the gladiolus, was found to produce in great abundance beautiful spherocrystals when grown on potato dextrose agar or

other suitable media. The crystals were composed of needlelike or threadlike parts radiating from the center, and upon treatment with iodine became blue in color. Of the 20-odd strains of *B. marginatum* studied, all produced crystals with some difference in the rate and regularity of formation.

The insolation of certain culture media, L. T. LEONARD and F. W. MARSH (*Jour. Bact.*, 15 (1928), No. 3, pp. 195-201).—Exposure of culture media of four kinds to sun rays during various periods and subsequent tests for changes in H-ion concentration and efficiency in supporting the growth of certain bacteria showed, in the case of beef agar and broth and soil agar, changes of H-ion concentration after 274 hours, but no changes in any of the other media.

The marked differences which appeared in some cases between the bacterial growth on the media insolated and on that unexposed, and colony development on these media for both periods of time, indicated variations, but these were not considered as sufficiently consistent to warrant definite conclusions. The significant finding from this work is that appreciable changes to which the organisms used are sensitive in these culture media occur only, if at all, after exposure to sunlight much greater than any which would be inadvertently given.

Food plants, II, D. BOIS (*Les Plantes Alimentaires*. Paris: Paul Lechevalier, 1928, vol. 2, pp. 637, figs. 261).—The present volume of this series (E. S. R., 60, p. 124) deals with fruit-bearing phanerogams, both indigenous and exotic.

Plant material introduced by the Office of Foreign Plant Introduction, Bureau of Plant Industry, [January 1 to June 30, 1927] (*U. S. Dept. Agr., Inventories Nos. 90* (1929), pp. 70; 91, pp. 46).—In these two issues descriptive information is presented on a total of approximately 3,343 lots of plant material introduced from various parts of the world for testing.

GENETICS

The genetics of the Tettigidae (grouse locusts), R. K. NABOURS (In *Bibliographia Genetica*. The Hague: Martinus Nijhoff, 1929, vol. 5, pp. 27-104, pls. 4, figs. 5).—The author discusses the genetics of the Tettigidae, including biology, breeding habits, reproductive systems, polyandry, chromosomes, parthenogenesis, and inheritance of various characteristics which have been studied in several species. Much of the information has been previously noted in Kansas Station Technical Bulletin 17 (E. S. R., 55, p. 26).

Cytological studies in *Cyperus*, *Eleocharis*, *Dulichium*, and *Eriophorum*, G. C. HICKS (*Bot. Gaz.*, 88 (1929), No. 2, pp. 132-149, pls. 2).—Counts at Harvard University on material collected near Boston and elsewhere near the Atlantic seaboard showed *Eleocharis*'s, so far as studied, to have the aneuploid chromosome numbers 5, 8, 8-9, 15, 18, 19, and 26-29, and *Cyperus*, so far as studied, to have the aneuploid chromosome numbers 17, 21, 48, 54, 73, and variable. *D. arundinaceum* was found to have 16 chromosomes and *Eriophorum virginicum* 29 chromosomes. Conditions resembling those found in known hybrids were discovered in *Eleocharis* and *Cyperus*. Cytological indication of hybrid origin was correlated clearly with taxonomic variability and polymorphy. Hybridism is offered as a probable explanation of the aneuploidy found in the Cyperaceae.

The chromosomes: The determiners of heredity and sex, J. ROSTAND (*Les Chromosomes: Artisans de l'Hérédité et du Sexe*. Paris: Hachette, 1928, pp. 282).—The author discusses the part played by chromosomes in the determination of characters in the Mendelian sense.

On the number of chromosomes observed in the somatic and reduction division of the cultivated apple in connection with pollen sterility of some of its varieties [trans. title], V. A. RYKIN (*Trudy Prikl. Bot., Genet. i Selekt.*

(*Bul. Appl. Bot., Genet. and Plant-Breeding*), 17 (1927), No. 3, pp. 101-120, pl. 1, figs. 51; *Eng. abs.*, p. 120).—An examination of the root tip cells of seedlings of 30 apple varieties showed all to have 34 somatic chromosomes. In two of the progenies, Champaign and Winter Golden Pearmain, there were certain seedlings with 51 chromosomes. Of nine varieties studied in reference to pollen mother cell reduction, eight were entirely regular. In the Canada Reinette reduction was irregular, giving rise to pentads and hexads, which in turn led to the formation of extremely heterogeneous and morphologically imperfect pollen. Canada Reinette, as determined in the tissues of the petals of young buds, had 51 somatic chromosomes. The pollen grains of this variety contained different numbers of chromosomes.

Chromosome numbers in *Scirpus palustris* [trans. title], A. HÅKANSSON (*Hereditas*, 13 (1929), No. 1, pp. 53-60, figs. 3; *Eng. abs.*, pp. 59, 60).—Plants of *S. palustris* from Holmsjö, Sweden, were found to have 19 haploid chromosomes, and plants from Lund 8. In both forms chromosomes of different sizes were found. It was observed that plants with different chromosome numbers may be very similar, although the plants with 19 chromosomes have larger fruit. The Holmsjö plants seemed to belong to a tetraploid race whose chromosome number has increased from 16 to 19 through transverse division of some chromosomes, rather than through duplication of whole chromosomes.

On the additive influence of multiple allelomorphs [trans. title], C. STERN (*Biol. Zentbl.*, 49 (1929), No. 5, pp. 261-290, figs. 13).—In combinations of as many as five allelomorphs for short bristles, a sex-linked character in *Drosophila melanogaster*, it was found that the expression of the character was proportional to the number of allelomorphs present. On the other hand, similar studies with stubble, an autosomal character, did not show the correlation between the expressed influence and the number of genes present.

The production of mutations in somatic cells of *Drosophila melanogaster* by means of X-rays, J. T. PATTERSON (*Jour. Expt. Zool.*, 53 (1929), No. 3, pp. 327-372, figs. 4).—Through a study of the effects of X-rays on sex-linked genes for eye color, in which 447 different cultures of eggs and larvae were treated, it was found that males produced from the treated cultures and carrying the dominant genes showed white mutant areas due to somatic mutations. Heterozygous females reacted similarly, while homozygous females showed no change in eye color as a result of the treatment. Some of the white mutant areas were principally due to gene mutations and others to chromosome breakage. The mutant areas in the eyes of males were white only, while in females from other crosses the mutant areas were light eosin and light apricot.

The mutant areas varied in size from the whole eye to single ommatidium, depending on the age at which the treatment was given, eggs and young larvae being more susceptible. No mutations were produced as a result of X-raying in the pupa stage. With the average X-ray treatment approximately 1 gene in every 9,891 mutated, while breakage occurred once in 713 X chromosomes which carried the dominant gene.

Only one certain reverse mutation was found in the eyes of 4,661 treated flies.

Heredity and natural resistance to disease, W. V. LAMBERT (*Sci. Mo.*, 28 (1929), No. 2, pp. 118-121).—The author discusses the variability of different strains of animals and plants as regards their resistance to specific diseases, and points out that studies at the Iowa Experiment Station indicate a genetic basis for disease resistance which is transmitted by both male and female parents.

The genetics of the genus *Phlox*, J. P. KELLY (*Pennsylvania Sta. Bul.* 243 (1929), p. 13).—Seeds of various interesting forms of *P. drummondii* observed

while visiting phlox growers in Europe were secured with a view to expanding genetical studies with this plant. Roots of *P. paniculata* were also secured. A short-styled form of perennial phlox when crossed with annual varieties gave rise to many hybrids.

A dominant white flower color in *Brassica oleracea* L., O. H. FRABSON (*Amer. Nat.*, 63 (1929), No. 689, pp. 561-565).—The discovery is recorded of certain white flowered plants of Jersey kale which, when used at the California Experiment Station as pollen parents in crosses with St. Valentine broccoli, gave rise to an F_1 generation about equally divided between white and yellow. Upon selfing, yellow F_1 plants yielded yellow progeny while white F_1 plants yielded a progeny containing approximately three white to one yellow. Back crosses resulted in progenies approximately equally divided between white and yellow, except in one case where the white ovule parent was apparently homozygous. The author concludes that white corollas in *B. oleracea* are conditioned by one dominant factor.

Dwarf, a new Mendelian recessive character of the house mouse, G. D. SNELL (*Natl. Acad. Sci. Proc.*, 15 (1929), No. 9, pp. 733, 734).—The author notes the appearance of dwarf mice which were about one-fourth the size of normal individuals at maturity. Approximately 25 per cent of the offspring produced in matings of heterozygous silver individuals were dwarfs, indicating that the character was due to a recessive unit factor.

Dwarf individuals were sterile. This character was evidently not sex-linked and probably not linked with pink eye or dilution.

A further study of size inheritance in rabbits, with special reference to the existence of genes for size characters, W. E. CASTLE (*Jour. Expt. Zool.*, 53 (1929), No. 3, pp. 421-454, figs. 11).—In a study of the inheritance of size in rabbits and its possible linkage to color factors, a large race carrying dominant genes for agouti, intensity, black, and English, representative of four linkage groups, was crossed with a small race carrying the allelomorphic recessive factors.

A back-cross of F_1 animals with the small race produced 16 different phenotypes numerically equal within the limits of the probable error, and there was no indication of a correlation between any phenotype and size. There thus appears to be no linkage between the genes for body size in the four linkage groups considered in the cross. Large and small body size are evidently inherited as a differential rate of cell multiplication and growth, but the mode of inheritance is unknown.

A postscript is included giving a critical discussion of a paper by Pease, previously noted (*E. S. R.*, 60, p. 631).

Crossbred herd supplies important facts on inheritance (*Illinois Sta. Rpt.* 1929, pp. 123-125, fig. 1).—Studies and observations by W. W. Yapp on approximately 500 animals produced in the Bowler herd, which was established by crossing Holsteins and Guernseys, indicated that milk yield, percentage of butterfat, protein, and ash in the milk, and conformation were hereditary characters controlled by a considerable number of factors, 10 being suggested for milk yield. The percentage of lactose in the milk was similar for the two breeds. The size of the animals was in part hereditary and in part environmental.

Skin color and color of the secretions were hereditary but were difficult to study on account of the high correlation with the amount of green feed consumed.

There was evidence that the open or protruding shoulder was an inherited character controlled by the operation of one or two factors. Variability in this characteristic was, however, influenced by the type of stanchions used.

The pigmentation of domestic animals as regards origin and relation to constitution and productivity [trans. title], E. ESSKUCHEN (*Arb. Deut. Gesell. Zuchtungs-k.*, No. 42 (1929), pp. IV+123, figs. 37).—The author discusses the chemical basis for pigmentation in mammals, including the method of production of pigments by specialized cells, and points out that the main function of pigments in the skin and hair of animals is for protection from light rays, though albinos are frequently constitutionally weak.

Rumplessness in the domestic fowl, G. B. JENKINS (*Anat. Rec.* 42 (1929), No. 1, p. 24).—A comparative study of the caudal pole of normal and rumpless chick embryos showed that there was a loss in the rumpless birds of all tissues, the loss being least in the skin and greatest in the nerve tissue. The lack of fertility of rumpless fowls was evidently due to the loss of essential parts and also to some undetermined factors.

A comparison of two blood lines of litter sisters of German Improved Landschwein with reference to body form and production [trans. title], H. KULOW (*Ztschr. Tierzucht. u. Zuchtungsbiol.*, 13 (1928), No. 1, pp. 1-92, figs 44).—A detailed comparison of the fertility and other characteristics of pigs produced in two blood lines is reported.

Comparison of the cyclic proliferative phenomena of the vagina, nipples, uterus, and mammary glands of the guinea-pig, S. B. DE ABERLE (*Anat. Rec.* 42 (1929), No. 1, pp. 1, 2).—Differences in the maximum and minimum height of the epithelium in the vagina, nipples, uterus, and mammary glands were found to be statistically significant when studied at different stages in the oestrous cycle in 24 virgin adult guinea pigs.

Differences in the proliferative responses suggested that more than one factor may be responsible for the control of the cyclic changes in these organs.

Human tubal ova, ovaries, and uterine tubes, E. ALLEN, J. P. PRATT, Q. U. NEWELL, and L. J. BLAND (*Anat. Rec.*, 42 (1929), No. 1, pp. 2, 3).—The authors describe tubal ova in different stages of development obtained by flushing the uterine tubes either immediately after removal or during operations. Ova were obtained on the fifteenth and sixteenth days of the menstrual cycle.

Evidence of a correlation between the amount of gonadal-stimulating hormone present in the pituitary of the guinea-pig and the stage of the reproductive cycle, P. E. SMITH and E. T. ENGRE (*Anat. Rec.*, 42 (1929), No. 1, p. 38).—In studies of the effect of transplanting the anterior pituitary gland from guinea pigs into immature mice, it was found that a slight ovarian response was secured from donors killed during the stage in the oestrous cycle when the vagina was open, while those killed during dioestrus gave a more satisfactory response. The results thus indicated that the amount of gonadal-stimulating hormone in the anterior pituitary is correlated with the stage of the oestrous cycle. Castration was found to augment the amount of the gonadal-stimulating hormone contained in the gland.

Vaginal curettage as a means of diagnosing pregnancy in the guinea-pig, G. L. KELLY (*Anat. Rec.*, 40 (1928), No. 3, pp. 373-383, pl. 1, fig. 1).—A method for diagnosing pregnancy in the guinea pig is described, based on the transition of the vaginal epithelium from the squamous type to simple columnar epithelium by the third week of pregnancy. Certain limitations of this method are pointed out as due to the presence of the columnar type of epithelium in immature females and in animals from one to two weeks after abortion and the delayed appearance of this type of epithelium until the third week of gestation.

Oestrus during pregnancy, W. O. NELSON (*Science*, 70 (1929), No. 1819, pp. 453, 454).—The author describes a case of the occurrence of regular oestrous periods in a rat during pregnancy.

Additional observations on internal migration of the ovum in the sow and in the guinea-pig, G. L. KELLY (*Anat. Rec.*, 40 (1928), No. 3, pp. 365-372, fig. 1).—In experiments in which one ovary was removed from sows and female guinea pigs, it was found that in the sow internal migration of ova had occurred, but that the bipartite uterus of the guinea pig prevented internal migration of ova.

Recovery of ovarian hormone from urine of injected monkeys, D. D. ROBERTSON and W. P. MADDEX (*Anat. Rec.*, 42 (1929), No. 1, pp. 61, 62).—Tests of the urine of ovariectomized monkeys injected with not over 60 rat units per day of the ovarian hormone showed that the monkeys excreted considerable amounts of the oestrous-producing hormone in the urine, while spayed controls gave negative results.

Effects induced in ovariectomized monkeys by injections of extracts of ovaries and implants of corpora lutea, D. D. ROBERTSON (*Anat. Rec.*, 42 (1929), No. 1, p. 61).—Relatively large injections of ovarian extracts and implants of corpora lutea into ovariectomized monkeys resulted in reddening and swelling of the sexual skin and changes in the vaginal smears and brought about typical early menstrual stages, but in no cases had the development of the uterine glands proceeded to the full premenstrual condition.

Spermatogenesis following early ovariectomy in the Brown Leghorn fowl, L. V. DOMM (*Anat. Rec.*, 42 (1929), No. 1, p. 15).—A large number of female Brown Leghorn fowls were ovariectomized at from 1 to 58 days of age. These birds developed male secondary sexual characters, and it was found that 5 of the 82 testis-like right gonads developing showed that active spermatogenesis was going on, though in no case was the entire gonad composed of spermatid tubules. It is assumed that surviving primordial germ cells gave rise to spermatogenesis in these cases.

A case of potential freemartins in cats, T. H. BISSENETTE (*Anat. Rec.*, 40 (1928), No. 3, pp. 339-349, figs. 6).—The author describes the anatomy in a case of two 14-mm. cat embryos having fused placentas, and suggests that since this condition does occur in cats the theoretical explanation of the sterile tortoise-shell tomcat based on its relationship to the freemartin may be sound.

The freemartin condition in swine, W. HUGHES (*Anat. Rec.*, 41 (1929), No. 2, pp. 213-245, figs. 32).—A more detailed description of the cases of fusion of the fetal membranes of pigs previously noted (E. S. R., 58, p. 221).

FIELD CROPS

[Field crops investigations in Florida], W. E. STOKES, R. W. RUPECHT, A. F. CAMP, W. B. TISDALE, J. H. JEFFERIES, G. E. TEDDER, ET AL. (*Florida Sta. Rpt.* 1928, pp. 20-32, 36, 37, 39, 40, 59-65, 99, 100, 108-110, 112-117, 121-123, figs. 3).—Variety tests with corn, cotton, oats, soybeans, and *Crotalaria*; breeding work with corn, peanuts, and pigeon peas; trials of winter legumes, cover crops, green manure crops, and lawn and pasture grasses; fertilizer tests with corn, oats, peanuts, potatoes, sugarcane, pasture, and tobacco; cultural (including planting) experiments with peanuts, corn, and soybeans; irrigation tests with Napier grass; a mulching test with potatoes; pasture studies; and crop rotations are reported on again from the station and substations (E. S. R., 60, p. 130).

Bahia, centipede, and carpet grasses responded to spring application of 175 lbs. of ammonium sulfate per acre with nearly practically doubled forage yields and showed a material increase in protein content as compared with no treatment. Centipede grass successfully crowded out all others in a test of 13

pasture grasses pastured continuously since 1922. Although eagerly grazed by the cattle, it is rather short for the purpose. Bahia grass, carpet, Bermuda, Dallis, and centipede grasses continued to be outstanding for pasture. While fertilizers tending to make a soil more acid did not control weeds on lawn grass plats, a mixture of aluminum sulfate, iron sulfate, and sand destroyed the weeds and seemed beneficial to the grasses. St Augustine and centipede grasses were outstanding for lawns, and Italian ryegrass, redtop, and Kentucky bluegrass were promising for winter lawns.

Peanuts did not respond to land plaster with a profitable increase, nor did any fertilizer treatment increase yields much over 100 lbs. of nuts per acre. Spacing tests indicated that planting Spanish peanuts from 3 to 4 in. apart in rows 25 and 3 ft apart may give larger yield increases than can be obtained by direct application of fertilizer.

Yields of sweetpotatoes and corn were higher after *Crotalaria striata* than after other cover and green manure crops. However, yields after such crops were not high and seemed to decrease with lapse of time, probably because of the naturally unproductive high, dry, deep, sandy land in which decomposition and leaching go on rapidly during wet weather. Trees on the cover crop blocks at the Citrus Substation did not differ materially, except that those bearing *Crotalaria* were noticeably greener and more vigorous. Trees cleanly cultivated showed considerable die-back and otherwise did not seem to thrive as well as those in cover crop blocks.

Results of the physiological and chemical determinations on *Crotalaria* by W. A. Leukel resembled those noted previously. The rate of nitrate formation from the leaves was more rapid than from the complete plant, which in turn exceeded that from the stems and roots. There was an actual utilization of nitrates formed from soil organic matter in the early stages of decomposition of the stems and roots for each growth period of the plants. Little or no difference was noted in the rate of nitrate formation from the leaves of the plants at different stages of growth. Nitrate formation from the complete plants turned under in the succulent and flowering stages of growth was slightly faster than in more mature stages, and the rate of nitrate formation from the roots and stems of plants in early growth exceeded that from similar plant parts in later stages.

The response of Napier grass to irrigation with sewage was similar to that in the previous year.

Bahia grass allowed to mature uncut made a more upright stem growth with poor formation of sod, whereas grazed plants produced a horizontal vegetative stem resulting in a dense sod. Stems of ungrazed plants contained more reserve organic food as compared with grazed plants. Bahia grass ungrazed for two seasons but cut often in 1928 has made 45 per cent more top yield than similarly treated grass that had been continuously grazed for two seasons. The stems assumed a more horizontal vegetative growth and again formed a dense sod.

With transplanted Bahia grass the total top growth from areas cut frequently during the growing season weighed less, green and dry, yet contained higher percentages of total and water-soluble forms of nitrogen than the one cutting made when mature. In its early stages the second top growth from the plats cut when mature resembled in composition the top growth from plats cut often. Stems of plants in the frequently cut areas produced a marked vegetative horizontal growth, formed a dense sod, and gained in weight until September, when a slight decrease occurred, and then gained weight again during autumn and early winter. When cut often and while enough soil moisture and soil nitrogen were available, more vegetative growth than re-

productive parts was produced. Plants cut when mature made a greater increase in weight of stems as the season advanced but produced less horizontal growth, making a very poor sod, than those cut more often. Stem weight fell markedly late in the season after the tops were cut, but the weight rose again in autumn and early winter. The roots of these plants weighed more to a depth of 8 in. than those of plants cut often. In early fall root weight decreased slightly in all plats, but increase was resumed early in the winter.

The decreased leaf area due to frequent removal of top growth resulted in a narrow carbohydrate-nitrogen ratio in plant parts during most of the growing season, which was associated with more vegetative growth and sod formation. Plants maturing and cut when mature contained more organic food reserves and showed a wider carbohydrate-nitrogen ratio resulting from the increased elaboration of carbohydrates. This wider ratio was associated with the production of more reproductive plant parts, more upright growth of stems and leaves, and less extended sod formation. After removal of mature top growth, aftermath in this area again showed a narrow carbohydrate-nitrogen ratio in its early growth similar to the top growth of the plants cut more often.

Potatoes at Hastings made better crops with some organic nitrogen in the fertilizer than with inorganic alone. As good yields were made with potassium chloride as with potassium sulfate without appreciable difference in the starch content of the tubers. Early February plantings made the best yield of prime potatoes. There seemed to be a critical period in the development of the potato plant at which a severe frost is most damaging. At La Crosse potatoes planted February 1 were mulched March 8 with cane pomace, but cool and wet weather thereafter evidently so accentuated the vigor of *Rhizoctonia* prevalent in the field that yields from the mulched area were considerably below those from unmulched potatoes.

Peanut plants on raw peat plats (E. S. R., 58, p. 209) at the Everglades Substation receiving copper sulfate alone suffered considerably for from a month to 6 weeks and resembled those on untreated plats in their response. However, when growth started they developed normally in every way and with extraordinary vigor. The early definite response to zinc sulfate alone was not particularly normal and soon broke down, leaving the plants as bad as or worse than the checks. It appeared that the early response to zinc might carry the plant into the copper treatment earlier and thus obtain a more continuous response and development. There was much fuller development of the peas and notably fewer pods on plants receiving the combination treatments. While nuts were seldom found upon plants of many check plants, the more favorable treatments gave yields nearly double the average for mineral soils. Comments are made also on the response of sugarcane and grasses to these and other treatments.

[Field crops investigations in Illinois] (*Illinois Sta. Rpt. 1929, pp. 38-46, 48-54, 56, 57, 58, figs. 4*).—Continued agronomic investigations (E. S. R., 60, p. 222) reported on included variety tests with corn and corn hybrids, winter and spring wheat, oats, and barley; breeding work and planting tests with corn; and observations on the winter hardiness of winter wheats and resistance of spring wheat to lodging.

New extremes were recorded by C. M. Woodworth and F. L. Winter in the experiment to alter certain chemical and physical characters of the corn plant, one ear of the high protein strain carrying 22.11 per cent of protein and one ear of the high oil 13.1 per cent of oil. The high oil strain averaged 11.25 per cent of oil and the low oil 1.29 per cent. Corn from the high protein

strain averaged 18.25 per cent of protein and the low protein strain 6.82 per cent. The height of the ears in the high ear and low ear strains was 92.8 and 7.5 in., respectively. Working with W. J. Mumm, Woodworth and Winter found that a variety of corn may be improved by selfing it a year and then mixing the remnant seed of selfed ears that are found to be best by a performance test.

In tracing the effect of seed maturity on the yield of corn, G. H. Dungan, W. L. Burlison, and B. Koehler found that the prime factor influencing yield was the field stand. Poor stands were the chief cause of low yields from seed harvested at the milk and glaze stages. However, the plants surviving had access to more land and apparently could produce about as much grain per plant as kernels from dented or mature seed. Inoculation of the seed with organisms causing the scutellum rot disease did not decrease yields from mature seed but did so with immature seed, the lowering of yield being somewhat greater for inoculated milk-stage seed than for glazed seed.

Contrary to previous results, Dungan observed that midseason varieties of corn yielded best at all three of the planting dates, May 13 and 28 and June 11; short season varieties, however, produced the best quality of grain, as measured by test weight per bushel. Corn planted June 15 on a dark Corn Belt soil at Sidell was improved in yield and quality by various systems of soil treatment in tests by F. C. Bauer and H. J. Snider, suggesting possibilities for late-planted corn in the event of corn borer infestation in Illinois. An average yield increase of 3 bu of corn per acre was produced by the better seed treatments applied to samples of farmers' corn by Koehler, Dungan, and J. R. Holbert. In nutrition studies E. E. DeTurk, F. M. Wilhite, and Holbert found that certain strains of corn responding to phosphatic fertilization are not as susceptible to disease as those not responding to phosphorus. Correlation was apparent between the resistance of different strains to cold injury and their response to phosphates.

Removal of blades of corn, in further simulated hail studies by Dungan, depressed corn yields severely, especially if done during the early silk stage. Likewise, quality of corn was reduced markedly by removal of blades, especially after the corn was in the early dent stage or when the silks were brown on from 56 to 70 per cent of the plants. Plants having blades cut off during the early silk stage could adjust the size of the ear to the reduced photosynthetic area of the leaf and, therefore, produced grain almost normal in quality. Corn lightest in test weight, or poorest in quality, came from plants deprived of their blades when 76 per cent of the silks were brown. Clipping off the outer, or tip, half of each blade was slightly worse than cutting out alternate 4-in. sections on each side of the midrib, although these types of damage were much more detrimental than the loss of one side of all the blades or the removal of half the number of blades. Breaking the midrib of each leaf was somewhat more harmful than slitting the blade to the midrib on each side, these mutilations during the early silk stage reducing yields slightly more than 20 per cent.

Because of climatic hazards, northern-grown seed potatoes continued to out-yield home-grown stock.

[Investigations with legumes in Illinois] (*Illinois Sta. Rpt. 1929, pp. 29-31, 32-38, figs. 2*).—Varietal tests with alfalfa, sweetclover, red clover, soybeans, and miscellaneous legumes and seeding tests with soybeans and various mixtures are reported on as heretofore (*E. S. R.*, 60, p. 223).

Yield and quality of grass hays, in tests by J. J. Pieper, were increased markedly by the inclusion of red clover in the seeding mixture, the best combination being timothy, red clover, and alsike clover. Timothy continued to be the outstanding hay grass. No combination of forage crops which included

alfalfa outyielded alfalfa alone, although alfalfa with timothy gave fairly good results. A mixture of oats and field peas was the most productive early emergency forage, and soybeans with Sudan grass made the best late emergency forage. Trials with sweetclover in hay mixtures showed that sweetclover alone yielded best. The biennial, white-flowered sweetclover outyielded other sweetclovers.

Observations and farmers' experience indicated that four years is the age at which most alfalfa meadows fail, one cause being the use of unadapted varieties. In comparisons by W. L. Burlison and J. C. Hackleman, most of the common alfalfas, especially the imported and the southwestern strains, made more growth than the others in the fall of the first year and showed little or no evidence of preparing for winter. On the other hand, all the variegated alfalfas and to a lesser extent South Dakota No. 12, Dakota and Idaho common, and several others made comparatively little fall growth, apparently building ample root reserves to carry through the winter.

Considerable variation was found by C. M. Woodworth in the percentage of abortive seeds among 100 selections of Illini soybeans, ranging from 16 to 27 per cent and averaging 22.2 per cent. Plants from bulk seed of the variety grown under like conditions had 21 per cent. Since no relation existed between percentage of abortive seeds and the potential number of seeds, it appeared that high yield may be combined with low percentage of abortiveness. The behavior of two genetic factors found in glabrous soybeans has been noted elsewhere (E. S. R., 61, p. 828).

Further studies by O. H. Sears revealed that one part of a field may have plenty of active nodule bacteria, while a more acid area may lack the organisms. In 11 soil experiment fields the time between the last crop of inoculated soybeans and the soil sampling ranged from 3 to 15 years. In practically every case a close relationship was noted between soil acidity and the nodule organisms. At LaMoille on limed plats the organisms apparently had lived for 15 years without host plants, and the same situation existed on an unlimed plat which had a much lower lime requirement than the limed plat. At Elizabethtown on distinctly acid soils there were no soybean nodule organisms, although soybeans had been grown only 3 years previously.

According to observations of Sears, H. E. Myers, and F. M. Clark, even though the nodule-forming bacteria of a certain legume produce nodules upon a second legume, the organisms of the latter may not necessarily infect the first legume. Such nonreciprocal cross inoculation has been noted with some cowpea and soybean nodule bacteria. The Woods clover organism produced nodules upon the garden bean, although no organism belonging to the common cross inoculation groups would infect Woods clover. When judged by nitrogen fixation, the Woods clover bacteria on garden beans was much less effective than the garden bean organism on its host. Temperature, light, and the nitrate nitrogen content of the soil also appeared to affect the degree of inoculation. Nitrate accumulation lowered the number of nodules produced under otherwise uniform conditions, although this unfavorable effect was lessened somewhat in the presence of light.

Some commercial cultures of legume bacteria were found by Sears to be very effective in nodulation and nitrogen fixation, while others were less efficient. No inoculants for nonlegumes have justified claims made for them.

That the value of soybeans for soil improvement is not limited to the nitrogen added to the soil through their nitrogen-fixing bacteria was confirmed by Sears and W. B. Paden, who found that soybeans affected the distribution of soil microorganisms and increased their numbers and activities. Consequently, corn yields were larger where corn followed soybeans.

In red clover seed studies by Pieper, W. P. Flint, and J. H. Bigger there was more seed per head in clover under cages in which the clover bees (*Tetralonia*) were kept, and the seed was heavier. Examination of a number of clover heads showed the average number of seed per head from cages with burrowing bees to be 44.1 and with bumblebees 38.1. In a second test the seed per head averaged 34.9 and 24.7, respectively.

The stand of red clover in spring oats was 41 per cent, in spring wheat 58, and in barley 81 per cent. Red clover sown in spring grain and clipped September 1 yielded 0.5 ton of hay per acre in the first fall, and the fall clipping favorably influenced the crop of hay and seed the next year. Tests of red clover seed from different sources gave results in harmony with those of previous years.

The chemical composition of girasole and chicory grown in Minnesota, H. P. TRAUB, C. J. THOR, L. ZELENY, and J. J. WILLAMAN (*Jour. Agr. Research* [U. S.], 39 (1929), No. 7, pp. 551-555).—Analyses of tubers of four varieties of Jerusalem artichoke (*Helianthus tuberosus*) at the Minnesota Experiment Station showed the Portland and Mammoth French white to contain more than 15 per cent of sugars on a green weight basis. The Mammoth French had the higher ratio of fructose to total sugars. The sugar content of tubers was relatively greater than of the tops. The total sugar and starch content of the tops was more than 10 per cent of the green weight and more than 30 per cent of the dry weight. Studies of two superior varieties of chicory (*Cichorium intybus*) gave indications that chicory is apparently as desirable as, or more desirable than, Jerusalem artichoke as a source of fructose. Chicory seemed to reach its maximum fructose content relatively earlier (September in Minnesota) than Jerusalem artichoke (November in Minnesota).

Yields of barley in the United States and Canada, 1922-1926, H. V. HARLAN, L. H. NEWMAN, and M. L. MARTINI (*U. S. Dept. Agr., Tech. Bul.* 96 (1929), pp. 84).—Supplementing a previous publication (*E. S. R.*, 54, p. 330), the results of variety trials with barley in the United States and Canada are compiled for the years 1922 to 1926, inclusive, although a few tables give results prior to 1922. Outstanding varieties grown at the experiment stations in the United States and Canada during the period are tabulated.

Prominent among the varieties in the United States are Trebi, Club Mariout, Coast, Glabron, Meloy, Horn, and Lion. Varieties showing up well in Canada included Bearer, Chinese, O. A. C. 21, Early Chevalier, Bark, and Star.

Flax cropping in mixture with wheat, oats, and barley, A. C. ARNY, T. E. STOA, C. MCKEE, and A. C. DELLMAN (*U. S. Dept. Agr., Tech. Bul.* 133 (1929), pp. 47, figs. 10).—Experiments concerned with several important problems involved in the mixed cropping of flax with cereals, carried on for four or more years largely in the flax-producing area, are published in cooperation with the Minnesota (*E. S. R.*, 51, p. 436), North Dakota (*E. S. R.*, 59, p. 825), Montana (*E. S. R.*, 57, p. 429), South Dakota (*E. S. R.*, 54, p. 34), Wisconsin (*E. S. R.*, 56, p. 733), and Ohio (*E. S. R.*, 59, p. 823) Experiment Stations.

With rainfall and other weather conditions favorable, a somewhat higher relative yield per acre seemed to be obtained from the mixed crop than from the two crops grown separately. Adequate soil moisture during the entire growing season appeared to favor a high relative yield of the mixed crop as compared with the same crops grown alone. Under droughty conditions the yields from the mixed crops were about the same as yields from the crops grown separately.

In general, the percentage of flax in the harvested crop has been less than that in the mixture sown, whereas the percentage of wheat or oats harvested has been greater than that sown. The quality of the flax and wheat in the

mixed crop, as determined by bushel weight and by weight of 1,000 seeds, equaled or exceeded that of the crops grown separately. Often the bushel weight of wheat was greater in the mixed crop than in wheat grown separately, and in some cases the difference was enough to make a difference of one marker grade.

In Minnesota, flax grown alone has produced a higher acre return than either wheat or oats during the years covered by these experiments. At Bozeman, Mont., the gross acre values of the mixed crops generally exceeded those of wheat or flax grown alone, due to the relatively higher yields of the mixed crops. On the basis of acre values there was little or no advantage in growing the mixed crops at Fargo, N. Dak. In the drier area, as represented by Mandan and Dickinson, N. Dak., and Moccasin, Mont., wheat generally made an acre return greater than that of flax alone or of any of the flax-wheat mixtures.

The control of weeds is probably the chief advantage of the mixed crop, which makes it possible to grow flax on land which is too weedy for flax alone. It was observed that the mixture of spring wheat, at about one-third the usual rate of seeding wheat, will check the growth of many common weeds, such as green and yellow foxtail, lamb's-quarters, amaranthus, and Russian thistle, whereas some of the perennials, such as quack grass, sow thistle, Canada thistle, and wild oats are not controlled by the practice.

Mixed cropping had little effect, so far as could be observed, on the prevalence of leaf rust or stem rust of wheat. Early seeding, usually practiced with the mixed crop, probably is helpful in reducing the loss from flax wilt where common or unselected flax is grown, and when combined with the shading effect of the wheat plants, early seeding prevents loss from heat canker, which sometimes causes damage in late-seeded flax. Neither heat canker, flax rust, nor pasmo was observed to injure flax in the experiments reported. When an epidemic of stem rust occurs, as in 1923 and 1927, a mixed crop partly insures against heavy loss, because the flax in the mixed crop is not damaged and should yield a moderate return.

Observations were that the mixed crops of flax and wheat and flax and oats are more easily handled in harvesting, shocking, and threshing than flax grown alone, which often is difficult to harvest and thresh because of the tendency of the flax straw to wind about the machinery of the harvester and to clog the screens of the separator.

Spacing and date-of-seeding experiments with grain sorghums, J. H. MARTIN, J. B. SIEGLINGER, A. F. SWANSON, D. R. BURNHAM, H. J. CLEMMER, E. H. COLES, F. E. KEATING, and W. M. OSBORN (*U. S. Dept. Agr., Tech. Bul. 131* (1929), pp. 47, figs. 9).—Extensive spacing and date-of-seeding trials with varieties of grain sorghums at nine field stations in the southern Great Plains are reported on, much of the work being in cooperation with the Kansas Experiment Station. See also an earlier report (*E. S. R.*, 52, p. 37.)

The optimum spacing between plants for the production of sorghum grain in rows from 40 to 44 in. apart averaged about 18 in. for Dwarf Yellow milo, 12 in. for Sunrise kafir, 9 in. for feterita, and 6 in. for Freed sorghum and for kafirs other than Sunrise. Wide spacing within the rows was found to increase the number of heads per plant and the size of heads and to decrease the number of heads per acre. The size of the kernels rose slightly with wide spacing. While wide spacing delayed maturity of the crop by an average of from one to three days, it did not affect the height of the crop consistently. The highest yields of forage were obtained from a narrow spacing of kafir plants in the row and a medium or narrow spacing of milo. Narrow spacing for all varieties is deemed necessary where the sorghum midge is abundant.

For the different varieties of grain sorghum the best spacings depend largely upon the number of heads produced per plant under conditions favorable for tillering. Varieties tillering freely, such as Dwarf Yellow milo and Sunrise kafir, are less affected by variable spacing than varieties such as Reed kafir which tiller sparingly. "The best spacing for any variety probably can be calculated by growing the variety along with standard varieties for which the optimum spacing is known, in 6-in. and 24-in. spacings, and determining the 'spacing index.' The spacing index is the product of two ratios—(1) the number of heads per plant in the 24-in. spacing divided by the number from the 6-in. spacing, and (2) the weight of grain per head in the 24-in. spacing divided by the weight in the 6-in. spacing. The spacing required is nearly proportional to the spacing index."

By growing plants in widely spaced rows (80 to 88 in. apart) with the same number of plants per acre as in 40- to 44-in. rows, yields of Dwarf Yellow milo were reduced about 2 per cent and kafir and feterita about 10 per cent. Stover and fodder yields of all grain sorghums usually have been decreased considerably by growing the crop in widely spaced rows. Grown in pairs of rows widely spaced between pairs the average yield of all varieties of grain sorghum was 4.5 per cent less than that from the ordinary rows.

For seeding the general optimum dates where insect injury is not probable were for Dawn, Sunrise, and Reed kafirs about May 15, Dwarf Yellow milo June 1, and Standard and Dwarf feterita and kaoliangs June 15. Medium-late seeding has resulted in better stands, taller stalks, larger heads, and shorter growing periods than did early seeding. The optimum date of seeding seemed to be related to the time of maturity of the variety. The earliness of seeding should be inversely proportional to the earliness of maturity. Milo and feterita are very sensitive to low temperatures at seeding time and ordinarily should not be sown until the soil is warm.

Some relation has been observed between the optimum date of seeding grain sorghums and the latitude, corresponding vegetative season, or length of day within the southern Great Plains. Although the distribution of rainfall has a pronounced effect upon the crop from various dates of seeding in a given experiment, it is too irregular to be a dependable indicator for dates of seeding in any locality. Ample moisture at heading time is held necessary for high yields. The temperature during heading time appears to be an important factor in determining the yields of grain sorghums; mean temperatures higher than 80° F. during heading result in shorter stalks, smaller heads, and lower yields than do slightly lower mean temperatures. Planting as early as possible to get a stand is considered advisable where severe injury from chinch bugs or sorghum midge is likely to occur.

Improved methods of harvesting grain sorghum, J. P. CONRAD and E. J. STERNIMAN (*California Sta. Bul.* 477 (1929), pp. 41, figs. 19).—The merits of different methods of harvesting grain sorghums are described from observations and from experiments at the station and in cooperation with growers.

High percentage of water in stalks, leaves, and sometimes in seed has caused most of the difficulties in harvesting grain sorghum. Agronomic studies suggested that adjusting the stand to the moisture supply and to the soil fertility is necessary for best yields and for uniform maturity. Thick stands, early planting, adequate irrigation during the early stages of growth, and no irrigation after the heads appeared gave good yields on fertile soil in many situations in the State.

Hand heading and combining, the principal methods used, have certain adaptations and disadvantages. Machine heading and binding also are em-

ployed to some extent. The combining of grain sorghum is increasing because the work can be done easily and cheaply with proper adjustments and under favorable conditions.

Cutting the roots (E. S. R., 56, p. 683) at from 5 to 7 in. below the soil surface to sever the plant from the moisture supply was found to cause rapid drying of the grain, stalks, and leaves in dry fall weather, so that combining may often follow safely in about 10 days. Special attention to varieties and to spacing of rows was shown to be necessary. Where the taller sorghums and the usual types of tractors are used, alternate wide and narrow spacing of rows is usually essential, while with the Double Dwarf varieties and a row-crop tractor normal spacing of rows proves satisfactory. The drawbar pull for cutting has varied with different soil conditions from 350 to 2,250 lbs. for a single row of sorghum. It was estimated that the operating cost of root cutting, where the soil is free from obstructions and the crop spaced adequately, should range from \$0.75 to \$1.50 per acre.

Variety tests of sugarcane in Louisiana during the crop year 1927-28, G. ARCENEAUX and F. D. STEVENS (*U. S. Dept. Agr. Circ. 88 (1929), pp. 16, fig. 1*).—Results of the 1927-28 varietal trials with sugarcane agreed with earlier findings (E. S. R., 59, p. 829) in that P. O. J. 213 continues to lead from the viewpoint of general suitability for culture and calculated sugar yields per acre. This variety responded favorably to rather early planting. Its behavior suggests that a larger percentage of the acreage should be planted in this variety.

P. O. J. 234 led in yield of sugar per ton of cane but had certain undesirable qualities, and P. O. J. 36 was not generally advised. It seemed best adapted to the western part of the sugar belt. P. O. J. 36-M, while similar to P. O. J. 36 in cane yields, was earlier and made more sugar per acre and compared favorably with P. O. J. 213 in several tests. The release of P. O. J. 36-M for general distribution and commercial culture in the State appeared to be justified. The merits of other P. O. J. and C. P. and U. S. seedlings are noted briefly.

Rate of deterioration of sugar content of some P. O. J. sugarcane varieties in Louisiana, G. B. SARTORIUS (*U. S. Dept. Agr. Circ. 97 (1929), pp. 27*).—The rate of deterioration of the sugar in sugarcane standing, windrowed, and cut for the mill has been studied in P. O. J. 36, 213, and 234 since 1925. Preliminary work has been noted (E. S. R., 59, p. 630).

Sugarcane windrowed after a light frost usually has deteriorated very rapidly. After a freeze severe enough to kill the growing point and most of the leaves, standing cane will keep about three weeks and cane windrowed immediately after the freeze about six weeks. It was observed that standing cane of P. O. J. 213 does not keep as long as the standing cane of P. O. J. 234 and 36, while P. O. J. 213 and 234 keep better in the windrow than does P. O. J. 36. Because of its early comparatively high sucrose content enough P. O. J. 234 should be planted each year to furnish stubble cane for the early part of the season. Plant cane of P. O. J. 234 should be cut late in the season in order to assure a good stand of stubble cane for the following harvest.

Recent experiments indicated that cane cut for the mill early in the season deteriorates very rapidly. After the cane has been frosted and is more nearly mature deterioration is much slower and may not occur for from 8 to 10 days after cutting. It appeared that under similar conditions unburned and burned cane deteriorate at about the same rate. Determinations on a number of single stalks showed that after the cane is cut for the mill the average daily loss of weight throughout harvest due to evaporation of water approximates 1.08 per cent. The deterioration of the stubble of early cut cane, according

to analyses of cane and rhizomes of stubble, is due to the exhaustion of the food reserve of the rhizomes. Little or no advantage seemed to be gained by shaving the stubble of the P. O. J. varieties of cane in Louisiana. The freezing of the cane did not affect the subsequent growth of the stubble in Louisiana.

Fertilizer studies and the production of sweet potatoes, F. W. GEISE (*Maryland Sta. Bul. 311 (1929), pp. 38, figs. 9*).—The results of fertilizer trials with sweet potatoes, already noted from another source (*E. S. R.*, 55, p. 436), are reported, and practical information is given on varieties, selection of seed stock, beds, cultural and field practices, harvesting, grading, storage, and diseases.

Effect of fertilizers on yield and quality of Pennsylvania cigar-filler tobacco, D. E. HALEY and O. OLSON (*Pennsylvania Sta. Bul. 243 (1929), p. 5*).—Fertilizer experiments in cooperation with the U. S. D. A. Tobacco Investigations indicated that the beneficial effect of potassium on the burning qualities of tobacco is due to a number of factors, one of which is its state of combination within the plant. Fertilization and other factors tend to modify this condition. Evidence showing a close relationship between potassium and iron on the process of cigar combustion has been obtained.

Results of seed tests for 1929, M. G. EASTMAN and B. I. GLIDDEN (*New Hampshire Sta. Bul. 246 (1929), pp. 20*).—The percentages of purity and germination are tabulated for 331 official samples of field crops seed collected from dealers in New Hampshire and tested during the year ended June 30, 1929.

Sodium chlorate as a lawn weed killer, F. A. WELTON (*Ohio Sta. Bimo. Bul. 141 (1929), pp. 188-190, figs. 3*).—Ground ivy or gill-over-the-ground (*Glechoma hederacea*) and thyme-leaved speedwell (*Veronica serpyllifolia*), perennial lawn weeds of trailing growth habit, are said to be destroyed easily by a single spraying with sodium chlorate. One or 2 oz. of the salt in 1 gal. of water suffices to cover 100 sq. ft., if a pressure sprayer is used, and may be applied in summer or fall, although probably best about November 1. Thin stands of grass remaining should be fertilized and reseeded.

HORTICULTURE

[**Horticultural investigations at the Florida Station**], **R. W. RUPECHT, A. F. CAMP, and J. H. JEFFERIES** (*Florida Sta. Rpt. 1928, pp. 35, 36, 50-54, 56-59, 63, 104-108, figs. 6*).—Further results in the potash fertilizer experiment with citrus (*E. S. R.*, 60, p. 139) were negated by a freeze which destroyed most of the fruit. In experiments at Vero Beach and at the Citrus Substation at Lake Alfred in which muriate, low grade sulfate, and high grade sulfate of potash were compared, no differences were found either in the rate of growth, as measured by increase in circumference of the trunk, or in the yield or quality of the fruit. The results are held sufficiently conclusive to justify the statement that in the Indian River section muriate of potash may be safely substituted, in part at least, for the high grade sulfate. September applications of fertilizer increased the yield of Satsuma oranges at Panama City.

Tomato fertilizer studies conducted in Dade County in cooperation with the U. S. Department of Agriculture indicated that with manganese sulfate, applied either direct or with other fertilizers at the rate of 50 lbs. per acre, good crops may be produced without the use of stable manure. Lime and copper salts proved harmful. Everglades muck was a satisfactory substitute for stable manure. A certain form of manganese iron waste gave inconclusive results.

Orchard heating studies with citrus showed that the age of the trees had a highly important bearing on results, since large trees prevented free movement of air and facilitated heating. At from 27° to 27.5° F. no ice formed

in Pineapple oranges, but when held at this temperature for some time and then lowered ice formation followed in a few minutes. Where the temperature was held at 26° for some hours ice was found in all the fruits examined. A small amount of ice did not necessarily cause permanent injury. Measurements upon Parson Brown, Pineapple, and Valencia oranges and Walters grapefruit showed a close correlation between growth and precipitation, particularly during periods of drought. Fall applications of nitrogenous materials failed to produce material increases in the size of tangerines and Parson Brown oranges. A daily variation observed in fruit size is attributed to the demands of the leaves for water and necessitated the taking of records in the morning period. It is suggested that the cube of the diameter should prove a more satisfactory criterion of size changes than the simple diameter.

A study of 153 samples of pecan nuts harvested from experimental fertilizer plats failed to show any marked differences due to fertilizer treatment. *Crotalaria sericea* and *C. striata* proved to be heavy producers of green cover crop material in pecan orchards. Trunk circumference measurements in a pecan orchard under rejuvenation in Jefferson County showed consistent gains despite their fungus injuries. Austrian Winter peas and hairy vetch planted October 26 produced abundant cover crops. Measurements of twig growth indicated a close correlation between the size and length of twigs and nut production.

Tabulated data are presented upon the size and weight of seeds, their oil and water content, and the growth of the trees in a tung-oil experiment in which various fertilizers were compared. Tung-oil trees withstood a temperature of 15° in January without injury. A device for maintaining uniform temperatures in the propagating bed is shown and described.

Cold winter weather was favorable to asparagus, inducing dormancy followed by the development of strong shoots.

Studies at the Citrus Substation included a comparison of rough lemon, grapefruit, and sour orange as stocks. The largest growth was made on rough lemon, and the trees on grapefruit stock proved shy producers. Sour orange proved to be a poor stock for the Lue Gim Gong orange when growing on high, sandy land. Partial girdling of root-injured seedling citrus trees was effective in inducing the formation of a new root system.

[Horticultural investigations at the Illinois Station] (*Illinois Sta. Rpt. 1929, pp. 209-218, 221, 222, 223, 224-230, 231-246, figs. 9*).—The apple breeding project discussed in the preceding report (*E. S. R., 60, p. 229*) and conducted by C. S. Crandall and J. C. Blair has yielded a total of 606 promising seedlings besides information on inheritance of various factors. A total of 47 forms of native and foreign crabs and 52 named orchard varieties have been used. In the peach breeding project the 15 most promising seedlings were propagated for wider testing.

Records taken on fruit varieties by R. L. McMunn show certain apples to require more than 11 years to reach blooming age. Under uniform spraying conditions there was noted a wide variation in the percentage of curculio-injured fruits in 22 varieties of plums. Following a winter minimum of -11° F. a few sweet cherries produced a small crop, but all Duke varieties were a complete failure. Dyehouse, Montmorency, and Early Richmond retained leadership in the sour group.

Work by W. A. Ruth and V. W. Kelley suggested that improper pruning in the early life of trees is a cause of the large percentage of poor heads. It is concluded that the removal of the entire central leader is incorrect in developing modified leader trees because such treatment stimulates several shoots,

the removal of which delays fruiting. Bud selection on 1-year whips is conceded a satisfactory method of starting young trees. Selecting buds from 8 to 10 in. apart with central leader was found better than closer location with removal of the leader.

Apple fertilizer studies conducted by M. J. Dorsey and R. S. Marsh indicated that calcium cyanamide is not equal to either nitrate of soda or ammonium sulfate as a source of nitrogen for the apple. Ruth, working at Olney, found that nitrogenous fertilizers should be applied rather close to the trunk where most of the roots occur, that drooping branches should be left to shade the soil, thus favoring root growth in the surface layers, and that shaded soil should not be tilled. Fine roots were relatively abundant close to the trunk and in the upper 3-in. layer, becoming progressively deeper and less frequent away from the trunk. Practically no fine roots were found in the upper layers of the unshaded soil on the southern side of the tree. Horizontal distribution was inversely correlated with the temperature of the surface soil in summer. Temperature increased from the trunk to the periphery where it was comparatively high. Data on the horizontal and vertical distribution of the roots of a healthy 15-year-old Jonathan tree showed shallow and concentrated development near the trunk.

Studies by Ruth and Kelley in a 23-year-old Grimes and Jonathan orchard near Urbana showed increased size, improved color, and easier spraying to follow pruning, with no indication of stimulating greater or more uniform production. Variability in flower production from tree to tree and within the individual tree was increased by pruning. The average percentage of full bloom on the pruned Jonathans in 1929 was 63.7 ± 2.6 and on the unpruned 74.9 ± 2.1 . Variability was almost twice as great in pruned as unpruned trees. Variation was always due to a reduction in flowering. As recorded by Kelley, all pruning treatments continued to cut yields and growth of vigorous 11-year-old Duchess and Wealthy trees. Unpruned, moderately thinned, and heavily thinned Wealthy trees in 1928 produced about 2, $1\frac{1}{4}$, and 1 bu. of fruit. Greater reductions were recorded on Duchess trees bearing a very light crop. Based on trunk area unpruned, moderately thinned, and heavily thinned trees increased 332, 277, and 250 per cent in size since 1924. Causes of lower production were smaller percentages of bearing wood and reduced size of trees.

Studies by J. W. Lloyd and H. M. Newell of apple shipping from Calhoun County in 1928 again indicated the need of better grading and of better transport facilities.

Peach thinning studies conducted by Dorsey and McMunn showed thinning of fruit on trees in good condition and well pruned to increase size invariably, though total yields were slightly reduced. Thinning was effective from the end of the June drop to the beginning of final enlargement, suggesting that growers may wait until natural dropping is well past.

As determined by McMunn, pruning and fertilizing of sour cherries had little influence on yields, except in the case of English Morello, which yielded almost double following heavy pruning and nitrogen applications. The size of the cherries was not affected. Incidental benefits from pruning and fertilizing were easier harvesting, better color, more uniform ripening, and easier spraying.

Based on nine years' observations in most cases, A. S. Colby presents descriptive and performance records on a large number of grapes and classifies them according to keeping qualities. Pruning experiments showed that long cane pruning is superior to spur pruning when canes of moderate vigor are used. Increased yield resulted from increased number and size of clusters on

the shoots. The larger clusters contained more and larger berries. On very fertile soil and with strong vines the G-arm Kliffin system increased yields. Gooseberry and raspberry breeding studies were continued. Adequate rainfall in 1929 made overhead irrigation of strawberries unnecessary. The Japanese quince was found generally self-fertile. Observations are made on miscellaneous shrubs.

Fertilizer studies with market garden crops, as reported by Lloyd, indicated that under the conditions many vegetables responded better to complete commercial fertilizer than to manure alone. As ascertained by Lloyd and E. P. Lewis, truck crops in Cook County yielded as well with commercial fertilizers and green manure as with animal manures. In the case of oilseed sets, all fertilizer combinations produced higher yields than did manure, except in one series which had no cover crop. With cabbage, increases in the percentage of phosphorus in the fertilizer were noticeably effective in increasing yields. Fertilizers high in phosphorus increased early yields of sweet corn and pickles. Highest total yields of cucumbers were obtained with manure but at higher costs. Similar results were obtained with other vegetables, suggesting that commercial fertilizers when supplemented with green manures may be used wholly or in part as a substitute for stable manure. All crops except spinach yielded as well with half applications of manure supplemented with 500 lbs. of high grade fertilizer as with full applications of manure alone. When used with manure, superphosphate was highly effective, except on peas and spinach.

As established by Lloyd and Lewis, curing asparagus for even 2 weeks during the first year after setting reduced yields, size, and weight of shoots the subsequent year. Substantial progress was made in the development of strains of tomatoes and beets desirable for the Chicago market. Strain tests of tomatoes, beans, and peppers showed wide variations in time of ripening, total yields, and quality.

Continued studies by W. A. Huelsen and M. C. Gillis on inbreeding of sweet corn resulted in 150 strains, many of which bred true for desirable characters. Incidentally, it was noted that toughness of hull in sweet corn is hereditary. Rowing was found to be incompletely dominant over zigzag arrangement. Fertilizing and rotation experiments demonstrated that limestone and clover alone are not sufficient to maintain sweet corn yields when grown for two years following wheat and red clover in a 4-year rotation. Superphosphate increased the yield in every case, but larger yields were secured when supplemented with nitrogen and potash. The application of 100 lbs. of fertilizer around the hill was practically equal to 400 pounds broadcasted. Further study was made by Huelsen of the causes of the blackening of canned corn, a condition now believed due to hereditary factors. With rows 3 ft. apart and seed spaced 1, 1½, 2, and 4 in. in the row, Gillis found close planting of beans to increase yields. The acre rates of seeding for 1½ in. spacing were 112, 135, and 90 lbs. for Red Valentine, Stringless Green Pod, and Stringless Refugee, respectively. Plant selection work by Huelsen and Gillis resulted in superior strains of tomatoes of better type, of increased resistance to wilt, and often of higher yielding capacities.

Transportation and storage studies with perishable fruits conducted by Lloyd and Newell are again reviewed (E. S. R., 61, p. 836).

That length of day is a potent factor in winter forcing of gladiolus was established by F. F. Weinard and S. W. Decker. Corms of the Virginia variety grown in California and planted in October bloomed about 10 days earlier and produced more than twice as many flowers under artificial light as did comparable lots under normal light. There were no consistent differences

between corms $1\frac{1}{4}$, $1\frac{1}{2}$, and 2 in. in diameter. Holding Halley corms over summer in cold storage did not enable them to bloom in midwinter.

Laddie carnations gave better yields on new than on held-over soil according to Weinard and S. W. Hall. Liming was apparently beneficial on both old and new soils in spite of low acidity. Yields with the Spectrum and Betty Lou varieties were practically as good on old as on new soil. Comparing summer-budded with winter-grafted roses, Weinard and Hall found but slight differences in yield of blooms per plant. The stems of budded plants were equally as long as those of grafted plants. In studies by Weinard and Decker the use of potash fertilizers failed to increase the resistance of greenhouse roses to black spot or mildew. Approximately 1,200 plants of single and Japanese peonies were studied by H. B. Dorner and Weinard in an attempt to unravel the nomenclature. Heavy cutting of peonies was found by Weinard and Decker to reduce the yields of the plants the next season, due to the loss of foliage on the cut stems. Nitrogen had a noticeable effect in increasing the amount of green color of peony foliage. Manure had a similar influence when used moderately. Superphosphate used with nitrate of soda tended to increase flowering, apparently being superior in this respect to steamed bone meal. Potash added to steamed bone meal did not increase flowering, nor did the potash-treated plants show any superior stem strength or resistance to disease.

[Horticultural investigations at the Pennsylvania Station] (*Pennsylvania Sta. Bul.* 243 (1929), pp. 15, 16, 24-27, figs. 3).—Studies by I. Hein upon mushroom growing indicated that the careful preparation of the straw compost results in increased yields. Beds 5 in. deep were as productive as the usual 7- to 8-in. beds. A correlation was noted between water content of the compost and the production of rhizomorphs. Mycelium grew best but with fairly few rhizomorphs with a water content of from 30 to 40 per cent; between 50 and 60 per cent abundant rhizomorphs and little filamentous mycelium appeared; and between 60 and 70 per cent no filamentous mycelium developed and stout profusely growing rhizomorphs were produced. Above 72 per cent water content all mycelial growth was inhibited. Thorough drying apparently killed the spores of mycogone.

Further studies by F. N. Fagan (*E. S. R.*, 59, p. 744) upon the debudding method of training young apple trees gave additional evidence in favor of this system. Records taken on the terminal growth remaining after the first year's pruning showed that debudding does not retard branch growth. After pruning the debudded trees averaged 49.6 in. of terminal growth as compared with 46.06 in. for the normally pruned trees.

As recorded by R. D. Anthony, the organic content of orchard soils is an important factor in their response to fertilizers. The most successful treatments were those which maintain good growth of cover crops or grass. The early seeding of cover crops was found to increase the production of organic material. In one orchard the continued use of nitrogen fertilizers induced a heavy growth of bluegrass, which apparently checked tree growth by utilizing nearly all of the available nitrogen.

Removing the apical bud from Earliana tomato plants when the fourth leaf was about an inch long was found by J. E. Knott to result in an increase of 32 per cent in the early yield of marketable fruits. The yields in the case of Bonny Best and Chalk Jewel were little influenced. The self-pruning varieties, Fargo and Viking, produced less marketable fruit than Earliana.

Knott and C. D. Jeffries report that better growth of tomato, lettuce, cauliflower, cucumber, and bush pumpkin plants was secured in clay pots or wood

vener bands than in paper bands or pulp and peat pots, except when rich potting soil was used. Apparently the supply of favorable nitrates in the soil was the major factor involved. In the paper, pulp, and peat pots the cellulose-decomposing organisms occupied in breaking down the pot walls evidently used the nitrates. Added nitrogen in solution tended to correct this deficiency.

Studies by C. E. Myers of selected strains of Early Jersey Wakefield cabbage showed them to be somewhat inferior to a commercial stock. Of 50 selected strains of Penn State Ballhead, only 10 proved significantly different when analyzed by Student's method. As a whole, Penn State Ballhead was superior in uniformity and yield to commercial varieties. Seasonal influences profoundly influenced susceptibility to blackleg.

Penn State Earliana, Matchum, and Nittany tomatoes developed at the station continued to prove superior to commercial varieties.

M. T. Lewis working with lettuce found certain strains of Big Boston and New York to be superior. Breeding work with lettuce was continued.

[Horticultural investigations at the Vermont Station] (*Vermont Sta. Bul.* 302 (1929), pp. 22, 24, 25).—A total of 43 samples of cherries were examined for acidity and sugar content. The pH value of the juice of Early Richmond varieties averaged 3.43, while that of the Windsor types averaged 3.73. The sugar contents, largely invert sugar, averaged 7.66 and 9.33 per cent, respectively.

A study of the underlying causes of sterility in the Bartlett pear embraced observations on selfed and crossed seedlings of this variety and upon flowers of trees inclosed in screened cages. No defect was found in the structure of pollen grains nor in tube growth in artificial media. Cytological examinations were also made upon the growth of pollen tubes in the pistils of both selfed and cross-pollinated flowers.

In the cherry grafting study, attempts were made to secure own rooted Early Richmond and Windsor trees by various means, such as layers, cuttings, ringing, etc. Self-pollination was employed in an attempt to develop uniform stocks for comparison with those obtained by the usual open-pollination method.

Field and sand culture experiments on fertilizing asparagus, T. H. WHITE and V. R. BOSWELL (*Maryland Sta. Bul.* 314 (1929), pp. 147-161).—An analysis of yield records taken on Palmetto asparagus planted in 1911 and fertilized for the first time in 1918 indicated that on the soil type utilized commercial fertilizers may be satisfactorily substituted for animal manures. The mean annual increases for the 9 years, 1918 to 1926, from 1,250 lbs. per acre of 7-3-5 (N-P-K) fertilizer and from 10 tons of manure were 35.99 and 28 per cent, respectively. Significant differences were not established between spring and summer applications of either manure or of fertilizer, although in the first 5 years spring applications were definitely superior.

Since the stalks on the check plots decreased in size while those on the fertilized areas showed but little change during the 9 years, it is concluded that fertilizers had a favorable influence on stalk size.

In another experiment, in which asparagus plants were grown in glazed tile cylinders filled with bank sand, animal manures gave larger yields which were significant. Inorganic materials gave comparatively small and variable differences from the checks. Furthermore, the results were complicated by the passage of the roots out of the tiles into the surrounding soil before the conclusion of the experiment. However, it was shown that nitrate of soda and tankage were better sources of nitrogen for asparagus than was ammonium sulfate, which, in fact, apparently depressed yields. Kainite gave favorable results, especially when used with manure.

Studies of premature flower formation in wintered-over cabbage, V. R. BOSWELL (*Maryland Sta. Bul. 313* (1929), pp. 69-145, figs. 18).—Date of sowing and autumnal growth as affected by the character of the weather were found important factors in determining the percentage of wintered-over cabbage to shoot prematurely to seed the subsequent spring. Other factors being equal, the larger the plants at the time growth ceased in early winter the greater the tendency to shoot to seed, the percentage of seeders increasing very rapidly with increasing size of plant above a stem diameter of 6 mm. That a few days difference in time of sowing may be highly important was shown in the fact that in plants of the same size those from September 4 seedlings produced a higher percentage of seeders than those from September 11 seedlings.

As determined by observations on plants taken into a greenhouse, exposure to low temperature is requisite to flower formation in cabbage but apparently operates only after the plant has accumulated sufficient reserves. That genetic factors may also bear on the problem was indicated in significant differences in bolting among various strains treated in identical manner. Fertilization in the seed bed increased winter losses and premature seeding, but fertilizer treatments in the field were without effect.

Determination of food reserves in the plants at various stages of development failed to show, up to March 1, any connection between chemical composition and tendency to bolt. However, just prior to seed stalk appearance the C : N ratio increased, as was expected. No apparent relation was established between the P : N ratio and fruiting. It is concluded that the greater tendency for larger and older plants to bolt is not due to percentage relationships in reserves but to the actual quantity of reserves present, a deduction further supported by the fact that defoliation significantly lowered the percentage of seeders.

Cytological studies showed flower primordia to be differentiated about February 1. As early as the middle of October the terminal apexes of potential seeders were definitely larger than those of nonseeders and continued this expansion throughout the winter, despite the apparent dormancy of the plants.

Practical conclusions are presented.

Lettuce growing, W. R. BEATTIE (*U. S. Dept. Agr., Farmers' Bul. 1609* (1929), pp. II+30, figs. 20).—A general discussion upon the commercial production of lettuce, covering such items as culture, fertilizers, varieties, insects and diseases, preparation for market and marketing, etc.

Variety studies of spinach, F. W. GEISE and H. B. FARLEY (*Maryland Sta. Bul. 312* (1929), pp. 39-67, figs. 19).—Technical descriptions are given for varieties of spinach, with suggestions relative to classification based on horticultural usage. A marked variation was observed in the time of flower stalk formation, the Virginia Savoy being one of the first to shoot to seed in the spring, while the King of Denmark was one of the latest. The tendency to shoot to seed often determined whether a variety was suited for fall or spring planting. The factors which render varieties suitable for planting in Maryland are discussed.

Studies of quality and maturity of apples, J. L. ST. JOHN and O. M. MORRIS (*Jour. Agr. Research* [U. S.], 39 (1929), No. 8, pp. 623-639, figs. 2).—Searching for standards of maturity, analyses were made of apples collected at various stages of maturity, from very green to hard ripe, and in storage. An increase in total sugars was the outstanding change in chemical composition during maturation on the tree. In respect to total acids there was no significant variation, but a slight tendency to decrease was apparent. Sucrose largely accounted for the increase in total sugars. Dry matter, ash, nitrogen, and reducing sugars showed no progressive changes through the season. The level of

sugars and other fractions varied from year to year, suggesting the impossibility of establishing constant, definite standards associated with any stage in ripening. Apples in storage showed a further decrease of acid and of alcohol-insoluble acid-hydrolyzable materials.

In respect to physical-chemical changes in the juice, there was recorded a progressive variation in H-ion activity and acidity of the juice, as measured by electrometric titration. The buffer value of the juice was about the same at the several stages of maturity.

Finding considerable variation in the quality of fruit within a variety, and even from a single tree, studies were made of the effects of various growth and environmental factors. Fruits of the highest quality were those exposed to the sun and attached to spurs which produced from the same winter bud a short, leafy twig carrying 10 or more leaves. That leaves influence the water content of fruits was observed in the case of detached spurs. The foliage of spurs with fruit gave off moisture more rapidly than did the foliage of comparable fruitless spurs. Fruit from the sunny side of the tree was higher in total sugars, reducing sugars, total carbohydrates, and alcohol-insoluble acid-hydrolyzable materials. In the Jonathan apple high quality was associated with maximum development of red color. Observations on water core in Delicious apples showed much more of this condition in fruits borne on medium length spurs which had also produced twigs from the same winter bud, suggesting a relationship between water core and foliar development of the spur.

Relation of picking time to acetaldehyde content and core breakdown of Bartlett pears, C. P. HARLEY (*Jour. Agr. Research* [U. S.], 39 (1929), No. 7, pp. 483-493, figs. 5).—Continuing studies (E. S. R., 59 p. 731) upon the relation of acetaldehyde to breakdown in Bartlett pears, studies were made upon fruits harvested at four stages of maturity and ripened under different storage conditions. It was found that the length of time elapsing from picking to the onset of core breakdown depended upon the stage of maturity when harvested, late picked fruits breaking down more rapidly than early picked fruits. Acetaldehyde was not found in any of the four lots of pears immediately after picking, but after two days at from 22 to 24° C. (71.6 to 75.2° F.) distinct quantities were found, increasing to a maximum about the time breakdown occurred. Acetaldehyde accumulation was more rapid in late picked fruit than in early picked and less mature fruit.

Analyses of the gases in the intercellular spaces of the tissue showed that the initial percentages of carbon dioxide were lower in the early picked than in the late picked fruits, and that the rate of accumulation was less rapid. The maximum carbon dioxide content was usually reached some time before the first visible indication of breakdown. In general, the increase in carbon dioxide during ripening accompanied a decrease in oxygen, but in some instances the percentages of both gases were quite high, leading to the hypothesis that no true carbon dioxide: oxygen ratio exists in the intercellular atmosphere as ripening progresses, and that respiration of the Bartlett pear may be in part intramolecular. The rôle of carbon dioxide and oxygen in the production of breakdown apparently lies in the establishment of optimum conditions for the acetaldehyde production.

The production and marketing of strawberries on the Eastern Shore of Maryland, W. E. WHITEHOUSE, W. J. HART, and W. P. WALKER (*Maryland Sta. Bul.* 315 (1929), pp. 163-185, 214-216, figs. 10).—Introductory to the major portion of the bulletin (see p. 337), information is presented on the distribution of the industry and the methods of production employed, including such items as soils, rotations, fertilizers, plant growing, planting, cultivation, harvesting practices, and the control of insect and fungus pests.

Mass selection of pineapple planting material (*Hawaii. Pineapple Cannery Sta. Bul. 1* (1925), pp. 10, figs. 5).—Four characters, namely, size and conformation of fruit, number of slips produced, and disease resistance, are analyzed in respect to their constancy and value as criteria in the selection of planting stock on a large scale. Data taken on the plant crop and the first ratoon crop of 565 plants showed larger fruit, 4.75 lbs., in the ratoon than in the plant crop, 4.25 lbs. Variability was greater in the ratoon crop, and the coefficient of correlation between weights of fruit of the two crops was 0.327 ± 0.025 , showing some but not high correlation. Regarding multiple crowns, an undesirable feature, there was no evidence of inheritance, with indications that heavy fertilization increased the percentage of such crowns. A condition of abnormal number of slips about the base of the fruit was found hereditary, as was also slender fruit type. The condition of prominent eyes on the fruit was not transmitted. In data taken on the number of slips produced by successive generations, the coefficient of correlation was 0.28 ± 0.058 , suggesting only slight inheritance. The transmission of disease resistance was not critically analyzed, but the undesirability of using slips from wilted plants was visibly evident in the inferior appearance of the progeny.

Experiments with the fertilization of pineapples, H. L. DENISON (*Hawaii. Pineapple Cannery Sta. Bul. 2* (1925), pp. 25, figs. 10).—Extended trials of various fertilizer materials applied to the plant crop and subsequent ratoon crops indicated that under conditions of natural fertility and good culture a good plant crop may be expected without fertilization, but that beneficial results from fertilizers may appear in the subsequent ratoon crops, often becoming very striking in the second ratoon crop. Nitrogen was evidently the most important limiting nutrient and was particularly beneficial in the ammonia and organic forms. Phosphorus needs were less acute but often became evident in the later years of a two-ratoon cycle. Supplementary applications of fertilizers designed to maintain vigorous growth during the later ratoon seasons were of evident value.

FORESTRY

Progress report of the Forest Taxation Inquiry.—Digest of State forest tax laws, F. R. FAIRCHILD (*U. S. Dept. Agr., Forest Serv., Apr. 15, 1929, pp. [4]+39*).—Included in this mimeographed report are a brief historical summary of the development of special forest tax legislation in the United States; a digest, by States, of the specified forest tax laws in force December 31, 1928; and a comparative table covering selected provisions of such laws.

[Report of the department of forestry], A. C. MCINTYRE (*Pennsylvania Sta. Bul. 243* (1929), pp. 22, 23).—Measurements taken in a black walnut plantation 21 years old showed an average diameter at 4.5 ft. of 5.4 in. and an average height of 29 ft. Nontransplanted seedlings 2 and 3 years old gave approximately 10 per cent greater survival in prepared furrows than in sod. In the case of 8 year-old red pine originally set 5 by 5, 6 by 6, 6 by 8, and 10 by 10 ft. there was a consistent increase in diameter growth with wider spacing, but height development varied little. None of the trees had reached the self-pruning stage.

Scrub oak because of its prolific sprouting and early seed production is judged unusually capable of reforestation of cut-over and burned areas. Records taken on unburned areas and on those 4, 9, and 19 years from burning showed a marked increase of better species with the passage of time. A wide range was observed in moisture conditions favoring germination of coniferous seeds. Some seeds germinated in moist chambers as well as in sand that was nearly saturated.

Forest botany [at the Vermont Station] (*Vermont Sta. Bul.* 302 (1929), pp. 20, 21).—Observations on the dry matter produced by tree seedlings growing under cover indicated that 1 gm. of leaves is as photosynthetically efficient under six layers as under one layer of cheesecloth.

Studies of forest reproduction showed striking variations both in the number and in the kind of tree seedlings, shrubs, and herbaceous plants in adjacent small plots and emphasized the variability of environment, even on very small sites. A comparable lack of uniformity was observed in the secondary growth in the forest, trees located on a plot 100 by 100 ft. showing marked variation in the thickness of new wood laid down. The percentage of seedlings to die each year was found so great as to render natural reforestation very slow, making this means of re-establishing a forest slow and expensive unless supported by good silvicultural management.

The relation of size of seedling trees to their vigor, R. R. PATON (*Ohio Sta. Bim. Bul.* 141 (1929), pp. 191-194, fig. 1).—Selecting in April, 1927, from 2-year-old seed beds of Corsican, Scotch, and white pines and Norway and white spruces three sizes of stock, it was found from subsequent measurements that, with the exception of white pine, the smallest trees had a lower growth rate in the field. The other species had definitely faster growth rates in the upper size groups; furthermore, the smallest stock suffered the greatest setback upon transplanting. The medium sized trees showed the greatest survival, except in the case of Scotch pine where the largest trees led. It is concluded that the smallest seedlings were inherently weaker and were therefore less desirable for planting.

Volume, yield, and stand tables for second-growth southern pines (*U. S. Dept. Agr., Misc. Pub.* 50 (1929), pp. 202, figs. 4).—The basic data of this handbook for professional foresters were obtained in extensive measurements of individual trees and pure, even-aged stands of second growth loblolly, longleaf, shortleaf, and slash pines growing in 12 southern and central States.

Wood, J. A. v. MONBOY (*Das Holz*. Berlin: VDI-Verlag G. m. b. H., 1929, pp. XII+318, figs. 288).—A comprehensive treatise on the production, exploitation, and utilization of wood.

DISEASES OF PLANTS

[Plant diseases, Florida], A. F. CAMP, J. R. WATSON, G. F. WEBER, and W. B. TISDALE (*Florida Sta. Rpt.* 1928, pp. 38, 39, 47, 54-56, 66-73, 100-103, 119, 120).—Besides a continuation of the temperature studies previously reported (*E. S. R.*, 60, p. 151), extensive trials were made of commercial dusts for seed disinfection of cotton, but none proved worthy of recommendation.

A survey showed the diseases most common during the first two months of the season to be sore shin caused by several organisms, particularly *Rhizoctonia solani*; angular leaf spot (*Pseudomonas malvacearum*); and wilt (*Fusarium vasinfectum*).

A study of the assimilation of nitrates by cotton was being made, particularly as regards the influence of soil temperature. This was to be correlated with the work on the time of application of a side dressing.

Work on *Fusarium* wilt was continued in connection with soil temperature. The *Fusarium* causing boll rots was found also to cause a serious damping-off of cotton seedlings, as well as the root rot of older cotton plants reported by Woodroof (*E. S. R.*, 59, p. 846). A large proportion of the seedlings bore *F. moniliforme*, which showed a definite pathogenicity, though with some variation in virulence among the different strains. This appeared almost as prevalent as *Diplodia*.

The work on the root-knot nematode (*Heterodera radiculicola*) confirmed previous experience (E. S. R., 60, p. 155) that the method used, the growing of immune plants, so reduces the nematode as to make the growing of truck crops reasonably profitable. In addition to velvetbeans, *Crotalaria*, though of slower growth, also appears to be immune to root knot, and thus usable as a cover crop. For treating seed beds, nothing better has been found than the double treatment of sodium cyanide and ammonium sulfate. Formaldehyde, though a good treatment for root knot, is more expensive. However, it also kills fungi which cause diseases.

In the rosette experiments, the plats of pecan trees receiving the commercial fertilizer, and in greater degree those receiving manure, showing a gradual improvement. The yield in the unfertilized plat has decreased 18 per cent since the work started.

In continuation of the previous reports on melanose experiments, a summary is given of the tests with 4-4-50 Bordeaux mixture followed by four oil emulsion sprays in 1927-28. Melanose was present only in slight degree, so that the value of Bordeaux mixture was left indeterminate.

A continuation of the investigations on citrus canker control by Loucks (E. S. R. 60, p. 146) established definitely the optimum temperature for the growth of *Bacterium citri* at from 28 to 30° C. and the maximum at 40°, with some growth at 10°, the lowest temperature tried. Hydrogen peroxide killed the organism in culture tubes within 30 seconds. Kumquats were somewhat resistant to inoculation but not immune.

Cucumber angular leaf spot and fruit rot are both conclusively stated to be due to *B. tayloriana*. In connection with cucumber downy mildew, sulfur was much more detrimental than in the trials of the previous season, and less efficient as a fungicide than Bordeaux mixture spray or than copper carbonate dust, which averaged somewhat better, holding the vines in production from 10 to 14 days longer than the check plants. Bordeaux mixture at 2-4-50 produced injury.

Tomato disease experiments conducted by Weber, with the aid of D. G. A. Kelbert and S. Hawkins, are detailed. In Dade County mosaic was more prevalent than ever before. Nailhead rust was a serious factor in Manatee County. Copper sprays reduced the disease from 40 to 24 per cent, copper dust to 30 per cent, and sulfur dust to only 38 per cent. Staked plants were less attacked than unstaked by nailhead rust.

Indications are that early blight of tomato, potato, and eggplant is caused by *Alternaria solani* and nailhead rust of tomatoes by another *Alternaria*. An apparently undescribed species of *Stymphylium* has been found to be of considerable importance on solanaceous plants, and has been partly studied as to host range.

A report of studies by E. West indicates that in commercial ferneries at least two important fungus troubles are present which require further study, these including a *Helminthosporium* and a stem disease of unknown causation. Most of the rust appears due to senility aided by semiparasitic organisms favored by weakness of the plants.

A. S. Rhoads reports work on citrus blight and psorosis. Trees requiring retreatment are usually the older ones which were severely infected and were treated formerly by early incomplete methods. Many trees contracted the disease through wounds made in pruning.

Chitocybe tabescens has been known to kill common guava, Australian pine, Cattley guava, and a peach tree infected from guava. Extremes of soil moisture appear to factor chiefly in citrus tree blight.

Strawberry diseases, studied by A. N. Brooks, though not wide-spread, caused in one field a loss of from 5 to 10 per cent of the young plants in formation. The causal organism is a Colletotrichum of species supposedly as yet undescribed. No wild host has been found. Partial control has been secured with Bordeaux mixture 4-4-50. The Missionary variety is not resistant to the leaf-spot organism (*Myosphaerella fragariae*) under conditions favorable to attack. The leaf blight organism (*Dendrophoma obscurans*) caused on inoculated plants spots which were increasing in size 10 days later. Two applications of Bordeaux mixture 4-4-50 gave control. Leaf scorch (*Diplocarpus earliana*) was abundant during the dry summer of 1927. No organism was demonstrated for the leaf "crimps," which was serious in 1927. An unhealthy root condition is thought to be nonparasitic. Root knot, present though not usually important in Florida soils, killed 25 per cent of the strawberries in one field. Dry, cool weather reduced the fruit loss caused by *Pericella* sp., *Rhizoctonia* sp., *Phytophthora* sp., and *Botrytis* sp. to a degree of minor importance.

Potato disease studies by L. O. Gratz showed no late blight (*P. infestans*) in the potato belt, though early blight (*A. solani*) became severe toward maturity. Southern brown rot (*Bacillus solanacearum*), developing rapidly in the early spring, was checked by rains and cooler weather about March 15. Seed treatment comparative studies were tabulated as employing corrosive sublimate, Semesan Bel, and Dip Dust. Significant increases of yield were given where spraying was compared with dusting, and significant decreases by dusting where the use of copper-lime dust was compared with no treatment. The seriousness of unchecked spindle tuber was again demonstrated (E. S. R., 60, p. 147).

Infection of the citrus aphid by *Empusa fresenii* was extremely light. The dissemination of the disease is thought to center around migrating adults over distances up to 500 yds. Inoculation experiments were conducted on tented trees with some success by W. A. Kuntz.

Pecan diseases, principally scab, were studied by R. E. Nolan at Monticello. Variation in susceptibility constitutes an important factor in making new plantings.

In connection with the very prevalent tobacco black shank, the field studies have been continued (E. S. R., 60, p. 152) in the search for resistant varieties. Some strains have shown favorable resistance, yield, and quality, and a number of crossings have been made.

Wildfire studies have shown that the organism does not overwinter in the soil, but that it lives in plant materials left on the beds. It was again shown that wildfire on young tobacco plants under shade can be checked by frequent heavy applications of Bordeaux dust, but the cost is high and injury results, so that it appears more practical to remove the diseased plants and replace with healthy sets.

Alternaria leaf spot studies have shown that all types of tobacco grown in the Quincy district are susceptible. Susceptibility increases with any check to growth, or when there is very vigorous growth and the plants are left longer in the field to ripen, especially when rainy weather occurs. The organism appears to be ubiquitous in this section. Again it was observed that the heaviest infection of bright tobacco occurred in connection with nematode attack and the late turning under of heavy vegetation.

Frog-eye leaf spot was common on both cigar wrapper and bright tobacco, causing on the former severe losses. Notes are also given on Phyllosticta leaf spot, root knot, and mosaic.

A report from J. L. Seal states that in work relating primarily to the yellowing disease of bush snap beans the disease appeared to be essentially physio-

logical, though a pathogene may be concerned. Isolations from root and underground stem lesions include species in the genera *Rhizoctonia*, *Fusarium*, *Rhizopus*, *Penicillium*, and *Aspergillus*. The only control yet secured was obtained by the use of the common fertilizers with the addition of special chemicals. R. V. Allison, who found (E. S. R., 58, p. 209) that beans grown on saw-grass peat gave a very definite response to some of the special chemicals, cooperated in tests on peat plats, results from which were not quite uniform.

[Plant disease investigations at the Illinois Station] (*Illinois Sta. Rpt.* 1929, pp. 46-48, 55, 56, 218-221, 223, 224, 230, 231).—Brief accounts are given of plant disease investigations, most of which are in continuation of previous reports (E. S. R., 60, p. 238).

[Corn disease control].—Investigations by B. Koehler, G. H. Dungan, and J. R. Holbert are said to have shown that scutellum rot susceptible seed yielded 17 per cent less than seed that was shown by germinator tests to be nearly disease free. Continued selections have proved their value in reducing the amount of scutellum rot.

The black-bundle disease caused by *Cephalosporium acremonium* was generally controlled through selection, but some evidence was secured that seems to indicate that infection may come from the soil. Losses from *Basisporium* were greater on productive soils than on unproductive ones.

As a result of experiments on the control of corn ear rots, it is concluded that open-pollinated strains of corn carefully selected over a period of several years suffered less from ear rots than unselected seed. Early-planted corn, on the average, will have less ear rot loss than late-planted corn. In rotations there was more ear rot in corn which followed corn than in corn which followed a leguminous crop.

Experiments in 1928 showed some slight increase in favor of seed selection for freedom from *Diplodia*, *Gibberella*, *Fusarium*, *Basisporium*, and *Cephalosporium*. Seed treatments also slightly reduced ear rots. Increases of 3 bu. per acre are reported as due to seed treatments.

[Oat hull protects against smut].—Evidence was secured by C. M. Woodworth and C. Veatch that indicates that the hulls on oats protect them to some extent against smut infection. The variety Markton seemed to possess resistance to this disease. Hull-less oats were found to be no more subject to infection than types of oats from which the hulls had been removed. However, hull-less varieties being without protection were found to be more liable to field infection.

[Apple disease investigations].—Experiments by H. W. Anderson are said to show no control of apple scab by sulfur dusts. Some forms of wettable sulfur gave commercial control, but it is concluded that lime sulfur must be depended upon to produce a high percentage of clean fruit.

Experimental work by the same investigator is said to show that by the annual cutting out of blister cankers the life of an apple orchard can be materially prolonged.

In searching for the cause and means of control of apple measles, Anderson found evidence to indicate that the disease may originate in the nursery. Differences in susceptibility are noted for various varieties of apples in Illinois.

The station collection of blight-resistant pears is said to number about 250 trees, and although blight was severe in 1928 those trees that were found to be resistant in former years remained free from infection. The commercial control of blight on the apple variety Willow Twig by cutting out the active cankers in 1927 and 1928 is reported by Anderson.

[Spray combinations for the control of bacterial spot of peaches].—Twenty-eight combinations of fungicides were tested by Anderson for the control of

bacterial spot of peaches, but while some appeared promising none gave commercial control. Among the fungicides that appeared most promising were cresylic acid and lime, some organic mercury compounds, and methyl violet. In connection with these experiments, the fruit of the variety Gage Elberta was found to be resistant to bacterial spot, and the leaves remained on the trees longer than those of standard varieties. Some of the peach selections previously made by Crandall and Blair (E. S. R., 60, p. 229) were found to be more resistant to bacterial spot than was Elberta.

[*Bramble disease control*].—A. S. Colby is reported to have shown that crown gall of raspberry could not be controlled completely by dipping the plants in fungicides before they were set out or by disinfecting the soil. The results of three years' spraying experiments for the control of blackberry anthracnose are said to show that a delayed dormant application of lime sulfur with Kayso was the most economical spray tested.

[*Plant pathology at the Pennsylvania Station*] (*Pennsylvania Sta. Bul. 243* (1929), pp. 13-15, 16).—Comparisons by H. W. Thurston, jr., of lime-sulfur spray, colloidal sulfur dust, SO-10-10 dust, and no treatment as controls for scab on McIntosh apples showed lime sulfur to be most effective, with colloidal dust a close second.

Among the several hundred highly fire-blight resistant or immune pear trees under study by E. L. Nixon, several are deemed highly promising. Resistant apples are proving valuable as rootstocks in areas where root blight is serious.

Studies by F. P. Gibbons and Nixon upon the growth habits of *Bacterium leguminosarium* indicated that this organism migrates in the form of zoöglöea, both intercellular and intracellular, and that in its later stages the invasion is intracellular. Passage through the cell walls was apparently gained through openings made by the dissolving power of the zoöglöea. Nuclear and cellular enlargement, accompanied by multinuclear condition, follows cellular invasion. Nuclear disintegration was observed in the later stages.

The bacterium, *Bacillus carotororus*, invades the intercellular spaces of the carrot in the form of a zoöglöea, which splits the cells in the region of the middle lamella and by the production of an enzyme plasmolyzes the cells.

Experiments by W. S. Beach showed that glass-protected tobacco plants almost without exception failed to develop wildfire disease even when infectious material was introduced. Mercury compounds tended to reduce wildfire but sometimes retarded growth. Some indication was obtained that insects may spread wildfire. Dry leaves preserved indoors, stems piled outside, and stems left in the field are, in the order named, potential sources of infection for seed beds. Clean crops were grown under shade tents from healthy seedlings even though diseased plants occurred just outside the tents.

[*Plant pathology [at the Vermont Station]*] (*Vermont Sta. Bul. 302* (1929), pp. 25, 26).—Conceding that magnesium may play some rôle in the maturing of plant life, it is concluded that this element is not the essential or the only factor involved. Lack of magnesium leads to chlorosis in young plants. Potato scab was found to be a potent factor in reducing the economic value of potatoes. Earlier reported studies upon the net-necrosis disease of potatoes are again briefly commented upon (E. S. R., 61, p. 48).

Influence of bacteriophage on *Bacterium tumefaciens*, and some potential studies of filtrates, N. A. BROWN and A. J. QUERK (*Jour. Agr. Research* [U. S.], 39 (1929), No. 7, pp. 503-530, figs. 5).—The addition of a highly diluted tumor filtrate to a young culture of *B. tumefaciens* from 2 to 4 days before use in inoculation resulted in the production of more quickly growing and larger tumors. Some evidence was obtained with the castor bean and carrot that

filtrates of normal plant juices also possess this stimulating power. A filtrate to which the organism was exposed as soon as possible after the tumor was crushed and filtered gave a culture which seemed to be quite as effective as filtrates oxidized several days, leading to the suggestion that fresh filtrates may cement the union of the bacteria and the bacteriophage more closely and a higher degree of virulence thus temporarily established.

Although no absolute lysis was produced in the experiments, the authors conceded the possibility that apple or rose strains of *B. tumefaciens* might be cultured with some tumor filtrate and produce lysis. The apple and the rose strains are deemed the weakest of *B. tumefaciens*, possibly because of the facile separation of the bacteriophage from the organism. The bacteriophage plaques appearing on the plates poured from a pure culture of the hop strain of *B. tumefaciens*, as well as on those poured from filtrate *B. tumefaciens* cultures, indicated that the lytic or inhibiting principle is carried along with the growth of the organisms irrespective of any active filtrate. The plaques from a pure culture were large and distinct but never so numerous as those on the filtrate-culture plates. The occasional occurrence of a tumor-juice filtrate carried in passages with *B. tumefaciens*, which apparently did not activate the young culture, is deemed to be possibly associated with the age or the rate of development of the tumor or the host of the tumor. The filtrate of very young tumors was unsatisfactory as an activator, due perhaps to the adherence of the bacteriophage to the more colloidal juice.

Determinations of the potentials of juices of normal and tumor tissues and *B. tumefaciens* in culture showed greater alkalinity, higher total acid content, and uniformly greater oxidation potential in the tumor juice, and established the presence of a bacteriophage.

Mosaic diseases in the Canary Islands, west Africa, and Gibraltar, H. H. McKINNEY (*Jour. Agr. Research* [U. S.], 39 (1929), No. 8, pp. 557-578, figs. 21).—Observations made by the author while a member of the Allison V. Armour expedition show that green mosaics occur on various plants in the Canary Islands, including *Solanum tuberosum*, *Capsicum frutescens grossum*, and *Nicotiana glauca*. Yellow mosaic, described as more devastating than the green types, was found on three plants of *N. glauca*. Inoculation experiments upon Connecticut-Havana tobacco with the 10 mosaics collected in the Canary Islands on *N. glauca* showed two types of green mosaic, a light green and a mild dark green form. Traces of a yellow mosaic virus were found in the green forms, especially the light green. A strain of the mild dark green mosaic was isolated which was apparently free of viruses of the yellow and light green types.

In west Africa green mosaics were found on eggplant, pepper, and other plants, and yellow mosaics on five species. Rosette disease was observed on peanuts in Gambia and Sierra Leone, and maize streak in the Gold Coast. In Gibraltar mild dark green mosaic was found on *N. glauca*.

Control of oat smut by seed treatment, S. G. LEHMAN and G. W. FANT (*North Carolina Sta. Bul.* 268 (1929), pp. 16, figs. 6).—Discussing briefly the nature of oat smut, the losses resulting therefrom, and the established formaldehyde treatments, the authors present the results of tests made in 1927 and 1928 of a number of chemicals and dusts, including copper carbonate, mercuric chloride, copper sulfate, copper carbonate and mercury chloride mixture, copper sulfate and mercury chloride mixture, monohydrated copper sulfate, Ceresan, P. M. A., iodine, Smuttox (all used as dusts), and formaldehyde and no treatment as checks. With both varieties of oats utilized, Frazier and Fulghum, complete control of smut was obtained with formaldehyde and Smuttox. Mercuric chloride and P. M. A. gave good control, and Ceresan was slightly less effective, and copper carbonate and copper sulfate failed to give practical

control. The monohydrated copper sulfate and iodine were least effective. In the case of Fulghum oats planted October 27, November 8, and November 30, much less smut occurred in the last seeding, a variation ascribed to soil temperature differences.

Observations both in the field and in the greenhouse on germination indicated that certain of the disinfectants had caused considerable seed injury. Formaldehyde was the most harmful, not only reducing but also retarding germination. Mercuric chloride alone or in mixture with copper carbonate or copper sulfate also caused injury. Ceresan, P. M. A., and Smuttox caused little, if any, injury and are deemed safe and effective disinfectants. With respect to yields, data taken on 6 Ceresan, 3 formaldehyde, and adjacent check rows showed average gains of 60 and 51.1 per cent of grain for Ceresan and formaldehyde as compared with the checks. Practical suggestions are made concerning the use of dusts.

Varietal resistance of spring wheats to bunt, W. E. BRENTZEL and R. W. SMITH (*North Dakota Sta. Bul. 231 (1929), pp. 42, figs. 2*).—Experiments conducted in cooperation with the U. S. Department of Agriculture at Fargo and Dickinson from 1926 to 1928, inclusive, upon the relative resistance to bunt of 28 spring wheats and 3 sorts of emmer as shown on inoculation of clean seed indicated in general, that durum wheats were about 100 per cent more susceptible to *Tilletia tritici* than to *T. levis*. The hard red spring wheats, on the other hand, were about 100 per cent more susceptible to *T. levis* than to *T. tritici*. The average resistance of the durum wheats to both species of bunt was about 30 per cent greater than that of the hard red spring wheats. Certain varieties were resistant to one species and susceptible to the other, and a few were susceptible to both.

In a date-of-seeding experiment at Dickinson, little or no smut was found in June seedlings, while serious infection was recorded in earlier seedings. However, early seedlings are generally more productive, suggesting the utilization of seed treatment rather than delayed seeding. Under favorable conditions smutted wheat heads were able to overwinter outdoors and produce infection in the succeeding crop.

The nematode disease of wheat and rye, R. W. LEUKEL (*U. S. Dept. Agr., Farmers' Bul. 1607 (1929), pp. II+12, figs. 8*).—Superseding Farmers' Bulletin 1041 (E. S. R., 40, p. 849), this paper contains general information on the nature and control of the disease on wheat and rye.

Disinfecting seed potatoes, F. WEISS (*U. S. Dept. Agr., Misc. Pub. 53 (1929), pp. 4, fig. 1*).—Supplemented with brief notes on diseases and underlying principles, four methods of treatment, namely, (1) corrosive sublimate, (2) cold formaldehyde, (3) hot formaldehyde, and (4) organic mercury dip, are discussed in this small service pamphlet.

The value of scabby potatoes, B. F. LUTMAN (*Vermont Sta. Bul. 297 (1929), pp. 16, figs. 9*).—The supposition that scab lesions would increase the weight loss of stored potatoes was borne out in records taken on tubers stored under dry, warm laboratory and cool storage conditions. In the laboratory scabby tubers lost 38 per cent in weight from fall to spring as compared with 30 per cent for clean tubers. In cool storage scabby tubers in shallow flats lost 25 per cent in weight against 17.5 per cent for clean tubers, while in bushel boxes the losses were, respectively, 21 and 15.5 per cent. That respiration loss was only minor was shown in determinations of the carbon dioxide output of tubers placed in sealed jars.

With paring losses averaging 15 per cent greater in scabby than in clean tubers, it is estimated that on the basis of actual nutritional value the scabby

tubers would be worth 82 cts. when clean tubers were selling at \$1. Considering the greater loss of weight in storage, the spring value of scabby tubers would be further decreased. With respect to seed stock value, allowing for the cost of disinfection, the relative value of scabby potatoes is estimated at 90 and 94 cts., depending on whether the clean stock was treated.

The overwintering of the tobacco mosaic virus, J. JOHNSON and W. B. OGDEN (Wisconsin Sta. Research Bul. 95 (1929), pp. 25).—Of the two possible original sources of overwintering tobacco mosaic, namely, living and dead plant tissues, the second source, comprising chiefly tobacco or tobacco refuse, is given main consideration in this discussion. The ability of the disease to survive for long periods in dead plant material was found to be an important factor in the infection of the subsequent crops. The frequency and extent of overwintering of the virus is dependent upon various factors, including the condition of the soil, moist and well-aerated soils, for example, favoring the inactivation of the virus as compared with the behavior in dry, compact or water-logged soils. Mosaic was frequently recovered from soil and roots which had overwintered in the field, and both were found to be important sources of infection of the new crop, although infection from the soil was rather gradual throughout the season. Plant refuse is also deemed important in the contamination of the seed bed.

As practical deductions, the authors point out the need of rotations for seed beds and field crops, together with sanitation measures concerning the handling of crop refuse to prevent its transfer to clean areas.

Studies of fire blight of apple in Wisconsin, P. W. MILLER (Jour. Agr. Research [U. S.], 39 (1929), No. 8, pp. 579-621, figs. 16).—Based on field studies from 1926 to 1928, it is concluded that weather conditions rather than insect activity are the potent factor concerned in outbreaks of fire blight. The organism was found to overwinter in association with canker and blighted twigs in the apparently healthy tissue immediately adjacent to the lesions. Varieties of apples differed greatly in the percentage of cankers and blighted twigs, Transcendent, Wealthy, Fameuse, and Yellow Transparent being severely affected and McIntosh, Dudley, and Northwestern Greening less so. Smooth-margined types of lesions were largely responsible for carrying over the disease. Rain and insects are considered the principal agents in spreading the secondary inoculum.

Studies of the mode of entry of the blight organism indicated that the pathogene can enter through the stomata, evidence to this end being noted in young apple leaves, sepals of unopened apple blossoms, and in the receptacle cups of apple and pear flowers. In the initial stages of invasion the bacteria were found free-swimming in the liquid of the intercellular spaces, and in later stages actually within the cells. In some instances the bacteria evidently migrated from cell to cell through apertures in the walls. Killing of the host cells was apparently the result of plasmolysis following the extraction of water rather than by direct toxicity. A histological study of tissue adjacent to hold-over cankers showed a concentration of bacteria in the sieve tubes of the phloem. Varietal susceptibility to fire blight was in the same order as the above given percentage of hold-over cankers.

Resistance to fire blight is considered to consist, in part at least, in the laying down of a corky barrier by the host. Variations in temperature did not, and variations in moisture did, have an effect on resistance. Apple flowers may be infected by fire blight for at least 150 hours after pollination.

Cutting out blight lesions during the winter period was tested and found of some benefit in reducing subsequent infection. Control of aphids did not give any significant results. Bordeaux mixture applied at blooming time afforded

little protection in 1926 and 1927, and the results of tests of various bactericides as means of inactivating inoculums which may escape the cutting-out process were inconclusive.

Cherry leaf spot control, H. C. YOUNG (*Ohio Sta. Bimo. Bul. 141 (1929)*, pp. 179-182).—Of four sprays, lime sulfur, Bordeaux mixture, mild sulfur sprays, and sulfur dusts, compared at Bellevue as controls for cherry leaf spot, lime sulfur proved the most effective material, the strength recommended being 1.25 gal. to 50 gal. of water. Bordeaux mixture, even in very weak solutions, caused serious foliage injury, and the mild sulfur sprays and dusts failed to meet the needs. It is suggested that the schedule of application should be governed by the development of the fungus and should begin with petal fall rather than shucks fall.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Fur laws for the season 1929-30, F. L. EARNSHAW and F. G. GRIMES (*U. S. Dept. Agr., Farmers' Bul. 1618 (1929)*, pp. II+30).—This is the fifteenth annual summary of the laws relating to fur animals (*E. S. R.*, 60, p. 355).

Hygiene in fox farming, K. B. HANSON (*U. S. Dept. Agr. Leaflet 47 (1929)*, pp. II+6, figs. 4).—This is a brief practical account of sanitary requirements.

Whitetailed deer, W. M. NEWSOM (*New York: Charles Scribner's Sons, 1926*, pp. XVIII+288, pls. 30, figs. 25).—This is a practical account of the common deer, its life and habits, its economy, and the sportsman's relation to it.

Bob-white useful to the potato grower, E. L. MOSELEY (*Potato Assoc. Amer. Proc.*, 15 (1928), pp. 259-262).—This is a discussion of the value of the quail and other enemies of the Colorado potato beetle. Reference is made to one quail that consumed 100 in a day. Another consumed 2,326 plant lice at one meal. In one day 5,000 chrysanthemum black flies were eaten, and in another day 1,286 rose slugs.

[**Report of work in entomology at the Florida Station**], J. R. WATSON (*Florida Sta. Rpt. 1928*, pp. 42-47, 47-49).—Reference is first made to work with the citrus aphid, *Aphis spiraeicola* Patch, noted by Miller (*E. S. R.*, 61, p. 754).

Fumigation work with citrus, in which calcium cyanide was dusted under the tents, has shown that a heavier concentration of hydrocyanic acid gas is necessary to kill white flies efficiently than is necessary for the Florida red scale or the purple scale, the latter scale being more resistant than the former.

Reference is made to injury by the southern green stinkbug in groves where *Crotalaria* was used as a cover crop. It was shown that *Crotalaria* is attractive to these bugs only when it begins to form young pods or at least to bloom, and that so long as green succulent pods remain on the plants the bugs will not leave them for citrus fruits, even for tangerines. If this bug be numerous, it may cause all the green pods to drop and then move on to the citrus, attacking not only the fruit but the limbs an inch or more in diameter. In practically all cases where this occurred it was found to be due to a mixture of beggarweed and *Crotalaria*. It was found that they breed in large numbers in the beggarweed during the summer, and when about October it begins to mature the bugs migrate to the *Crotalaria*, where they may be numerous enough to cause all the pods to drop. Their attack by parasites, particularly the tachinid *Trichopoda pennipes*, and by predators, may control this bug or almost exterminate it.

The red spider mite during the dry weather of early winter became very numerous and gave considerable trouble on citrus and in one county on

Asparagus plumosus. A mixture of sulfur and an unknown oxidizing agent supplied by a commercial concern appeared to give much better control than the sulfur ordinarily used for the purpose. On the asparagus, pyrethrum compounds and the spray of Derrisol also gave better control than ordinary flowers of sulfur.

Over a thousand parasites of the cane borer (*Loxophaga*) were received from Cuha and liberated during the fall.

The Florida flower thrips became extremely abundant during April, but the outbreak was too late to damage the citrus bloom or young fruit. Observations of the year indicate that it is not as strictly confined to blossoms as heretofore believed, since it appears to be able to breed on any very tender vegetation. The tobacco thrips was found to infest narcissus rather commonly.

Spraying experiments with the pecan nut case bearer indicated that the application of arsenicals is without value as a control measure for this insect. It is thought that the application of dormant sprays will be the most practical means of controlling the pest. The shuckworm was found to be less injurious than in the preceding year.

[Work in entomology at the Illinois Station] (*Illinois Sta. Rpt. 1929, pp. 138-151, figs. 2*).—A summary of the results of a study of the infestation and average yields of 39 varieties of corn grown in a European corn borer infested area near Toledo, Ohio, in 1928, conducted cooperatively for the Illinois Natural History Survey and the U. S. D. A. Bureau of Entomology by W. P. Flint and G. H. Dugan, is presented in tabular form. It is pointed out that while the data indicate some rather striking differences in degree of infestation they represent only a single season's work. Further work was conducted with corn borer parasites, many thousand being liberated, most of which represented a single egg parasite that works not only on the European corn borer but also on eggs of a number of other insects. The year's work indicates that it may be possible to utilize this parasite in orchards to control the codling moth and possibly to aid in controlling the oriental fruit moth.

It was found by J. H. Bigger that the severe damage caused by the grape colaspis to young corn following red clover in central Illinois may be controlled by early fall or early spring plowing of red clover fields, most of the damage having occurred in fields plowed late in the spring. None of the various dip and dust treatments of seed for the control of certain corn root and stalk diseases had any noticeable effect in preventing infestation by insects such as cutworms, wireworms, corn root aphid, and white grubs.

Measures for combating the apple leafhopper, which damages alfalfa and may be one of the limiting factors in the production of red clover hay and especially destructive to foreign clovers, include (1) cutting the alfalfa as soon as injury begins to appear, (2) use of native red clover seed, and (3) use of adapted varieties of soybeans.

Work with the codling moth, by Flint, P. A. Glenn, S. C. Chandler, and Bigger, the details of which are presented in tabular form, indicated that certain oil sprays, or oils combined with other insecticides, are fully as effective as arsenate of lead in late brood sprays but that they can not be used throughout the year.

A survey for the oriental fruit moth, which was first found in the State during the winter of 1927-28, has shown it to occur in the principal peach-growing areas throughout the area south of a line drawn from Vincennes, Ind., to St. Louis, Mo., and probably in scattered infestation north of this line.

It was found that the onion maggot, which frequently destroys 50 per cent or more of the onion crop in the large producing sections of Cook County,

can be controlled on a commercial scale by the use of a 2 per cent boiled lubricating oil emulsion in Bordeaux mixture. Progress was made during the year with the isolation of two new parasites of the onion maggot, namely, a staphylinid, *Baryodma verna* Say, and a thread worm, *Hexameris* sp. Three per cent parasitism was secured with the former and 5 per cent with the latter. A homemade nicotine dust at 2.4 per cent strength was the most effective of a long list of materials used to control the onion thrips.

Search for substitutes for arsenate of lead for use on truck crops has shown that some of the refined oil emulsions and some of the plant poisons are highly promising, although the toxicity of none has been found superior to arsenate of lead.

The most practical control for the destructive cyclamen mite ever developed was discovered in paradichlorobenzene. It was found that placing about $\frac{1}{6}$ oz. of this chemical, or a paradichlorobenzene ball the size of the ordinary moth ball, in the cyclamen flats when the plants are first set out will almost completely clean even heavily infested plants of mites. Thus far, no injury has been done. Plants treated with the material came through the season with the normal foliage and produced a heavy bloom. Ordinary naphthalene moth balls used in the same way seemed a little less effective and are more likely to cause injury to the plants. The work was conducted by Flint, M. D. Farrar, C. C. Compton, and F. F. Weinard.

Control experiments with the greenhouse leaf tyer, conducted by Compton, indicated that the pest can be successfully controlled by dusting the under side of the leaves with a mixture of 85 per cent sulfur and 15 per cent arsenate of lead. Trapping the moths was found to be helpful in controlling the pest, white lights of at least 200 watts being much more attractive than red, blue, and green lights. Experiments with baits in which geraniol, ethyl butyrate, amyl acetate, and methyl salicylate were used as attractants did not prove so effective as the light traps. Steam sterilization of the soil has been found to be the only sure method of controlling the earthworm, which often becomes troublesome in the greenhouse. The most satisfactory control of garden centipedes, which have increased markedly in abundance and destructiveness in greenhouses of the State, consists in raising the benches supplied with new soil and thus breaking the contact with the subsoil.

[Studies of insects and related pests at the Pennsylvania Station] (*Pennsylvania Sta. Bul.* 243 (1929), pp. 29-31, fig. 1).—In control work with millipedes C. A. Thomas found that the placing of calcium cyanide in the plow furrow and then covering it was only partially effective when used in coldframes in which asters and pansies were subsequently planted. Soil moisture is said to be an important factor in the failure to control this pest.

Spraying and dusting experiments for control of apple insects were conducted by H. N. Worthley, the check plat of McIntosh in 1928 having showed 18.5 per cent injury from fruit worms and leaf rollers and 8.5 per cent injury from the plum curculio, damage from other insects being insignificant. Spraying was found to control the early chewing insects somewhat better than dust, the sprayed plat showing 2.8 per cent injury, colloidal sulfur dust 3.3 per cent, and 80-10-10 dust 4.3 per cent from this source. Both sprayed and dusted plats showed slightly more curculio damage than the check, indicating that none of the treatments applied had any effect on the activities of this insect.

In work with the oriental fruit moth in 1928 by S. W. Frost baited blocks of peach trees showed more injury than the check at picking time, indicating that the moths were attracted from the check. Small baited blocks of trees showed no material reduction of infestation. Whether or not the palling of

an entire orchard, or the arrangement of baits to attract moths away from the orchard, would be effective still remains to be determined. Information was gathered on the attractiveness of fermenting sugar baits to a number of other economic insects, the cherry fruit fly and cutworm moths being especially attracted. The codling moth and red-banded leaf roller were attracted freely, but it is considered doubtful if baits could be relied upon to control them.

Studies were made by Thomas of the natural enemies and control of wireworms affecting truck crops. Carabid beetles and birds appear to be the chief enemies of wireworms in the State. Most of the various repellents used on seeds that possessed repellent value prevented germination. One pyrethrum compound was found to repel *Phaeletes agonus* larvae and did not interfere with germination. A bran bait containing nitrobenzene was not as attractive to *P. agonus* larvae as a bait of corn or bran without the nitrobenzene. Clover baits attracted adults of the wheat wireworm but were not effective for *P. agonus*. Plowing in late July and August killed many pupae and transforming adults in their cells, but did not affect many larvae unless birds followed the plow and fed on them. It was found that plowing must be more than 8 in. deep to be effective.

In studies of mushroom insects Thomas found a small noctuid looper feeding on the caps. An undetermined hymenopterous parasite was reared from sciarid flies. The burning of sulfur in the houses during the heating of the manure killed many flies, mites, and springtails which were driven to the manure surface by the heat. Great care must be used or it may retard or kill the spawn subsequently placed in the manure.

A study was made by Worthley of the effectiveness of different plows and attachments in covering cornstalk debris in European corn borer control. The walking plow equipped with chain and wire was more satisfactory than a 16-in. 2-bottom tractor plow with trash shields and an 18-in. 2-bottom tractor plow with which it was compared. No plow, however, covered trash well enough for corn borer control when working in standing stalks, either in the fall or spring.

A report of work with the codling moth by Worthley includes an illustration of one type of cage used in studying the effect of direction of exposure on the time of emergence of the codling moth. Records taken of the pupation of larvae and the subsequent emergence of moths of the summer generation of 1928 showed that for this brood emergence is little affected by the exposure of the transforming larvae. The peak of emergence of moths from all situations came between August 3 and 7. Chemically-treated bands for killing cocooning larvae were ineffective against transforming larvae of the spring brood and not markedly effective against hibernating larvae unless they remained in the bands all winter. The bands seemed to be too weakly impregnated with the chemicals to kill many larvae, but were strong enough to check a disease which was epidemic, taking 40 to 50 per cent of the larvae in untreated bands while only 18 to 24 per cent of the larvae in treated bands died. In the spring of 1929, 82 per cent of the larvae in treated bands were dead as against 58 per cent in untreated bands.

[Report on cotton insect studies at the Florida Station] (*Florida Sta. Rpt.* 1928, pp. 40, 41).—In a brief report presented by the assistant entomologist, reference is made to the manner in which the boll weevil ingests poison, an account of which by Grossman has been noted (*E. S. R.*, 58, p. 760).

It is concluded that the most effective and economical method of poisoning is that of commencing as soon as the cotton first squared and continuing for about four weeks, by which time practically all the weevils emerging from

hibernation in the open have found their way to the cotton fields. Hibernation studies for three successive seasons have shown the heaviest emergence to extend from late in May through June, with the maximum occurring about June 18. This information indicates that early season poisoning should start with the formation of squares and continue through the month of June. In one experiment in the hibernation studies conducted under artificially controlled humidity and temperature conditions, 25 per cent of the weevils survived the winter successfully. Parasites of the boll weevil were found to be killing large numbers of weevils.

Animal enemies of tobacco [trans. title], A. BUONOCORE (*Bol. Tec. [R. Ist. Sper. Coltiv. Tabacchi, Scafati]*, 26 (1929), Nos. 1, pp. 9-20; 2, pp. 77-84).—This is a continuation of the account previously noted (E. S. R., 61, p. 548).

Citrus pests and their control in Louisiana, W. E. HINDS (*La. Agr. Col. Ext. Circ.* 122 (1929), pp. 34, figs. 15).—This is a practical summary of information on the more important enemies of citrus and means for their control.

Subterranean pests and their control [trans. title], F. WILLAUME (*Rev. Zool. Agr. et Appl.*, 27 (1928), Nos. 1, pp. 6-8, pl. 1; 3, pp. 37-49, pls. 2, figs. 7; 9, pp. 133-140, pls. 2, figs. 3; 28 (1929), Nos. 1, pp. 5-12, pl. 1, figs. 3; 5, pp. 71-75, figs. 4).—This account includes a tabular list of the species of May beetles, their distribution, and injury in the grub stage; an account of nematodes attacking plants; etc.

The animal parasites, E. F. GALIANO (*Los Animales Parásitos. Barcelona and Buenos Aires: Editorial Labor*, 1928, pp. 199, pls. 10, figs. 108).—This is a practical handbook.

Household insects and their control, A. GIBSON and C. R. TWINN (*Canada Dept. Agr. Bul.* 112, n. ser. (1929), pp. 84, figs. 91).—A practical summary of information on the more important household insects.

[**The longevity of Cimex**], C. W. STILES and B. COLLINS (*Jour. Parasitol.*, 15 (1929), No. 4, pp. 291, 292).—A survival of 21 months wrapped in newly bleached sheets is recorded for the bedbug.

Leafhopper injury to clover and alfalfa, H. H. JEWETT (*Kentucky Sta. Bul.* 293 (1929), pp. 155-172, figs. 9).—This is a report of studies conducted with a view to determining the relation of leafhopper (*Empoasca fabae*) injury to the failure of clover and alfalfa in Kentucky. The discovery of the relation of the leafhopper to alfalfa yellows was first recorded by Jones and Granovsky in Wisconsin in 1926, as previously noted (E. S. R., 56, p. 756).

The author has found that this leafhopper through its feeding does great injury to clovers and alfalfa, and that a single adult or nymph may cause the death of young plants. The injury is manifest by the wilting of leaves and tips of stems, the discoloring of leaves, dwarfing of the plants, and dying of parts of plants or the plants themselves. The plants are most severely injured at about mid-season or a little later, because the leafhoppers are more numerous at that time. Thus their injury is another cause, direct or indirect, of the failure of clovers and alfalfa. Foreign clovers are affected by the feeding of the leafhopper to a greater extent than are native strains of clovers, the Italian red clover being more severely injured than the French red clover. The Kentucky strain of red clover was the least injured of any of the clovers tested.

A new species of Dasynus Burm. injurious to pepper in Java (Heteroptera Coreidae), W. E. CHINA (*Bul. Ent. Research*, 19 (1928), No. 3, pp. 253, 254, fig. 1).—Under the name *D. piperis* n. sp. the author describes an hemipteran injurious to the leaves of Piper in Java.

The carrot psyllid (Trioxa viridula Zett.), its biology and its distribution in Sweden [trans. title], O. LUNDELAD (*K. Landtbr. Akad. Handl. och*

Tidskr., 68 (1929), No. 3, pp. 337-379, figs. 19; *Eng. abs.*, pp. 377, 378).—This account, presented in connection with a list of 21 references to the literature, deals with a psyllid which is distributed all over Sweden and has caused very great damage in southern parts of the country. In some districts it has made the cultivation of carrots impossible.

Imported insect enemies of the gipsy moth and the brown-tail moth. A. F. BURGESS and S. S. CROSSMAN (*U. S. Dept. Agr., Tech. Bul.* 86 (1929), pp. 148, pls. 6, figs. 55).—This is a somewhat detailed review of work with imported insect enemies of the gipsy and brown-tail moths which has extended over a period of more than 20 years. The authors give a summary of the life history and habits of these two pests; early work against them; their abundance and spread from 1905 to 1927; early and recent foreign work; the receiving and handling of foreign material at the gipsy-moth laboratory; foreign insect enemies of the gipsy moth positively established, including 2 egg parasites, 4 larval parasites, and 2 enemies of the caterpillars and pupae, also foreign enemies of the gipsy moth not positively established, including 14 larval parasites, 2 pupal parasites, and 3 enemies of caterpillars and pupae; foreign enemies of the brown-tail moth positively established, including 5 larval parasites and 1 pupal parasite; total colonization of gipsy and brown-tail moth parasites and predators; and natural mortality of the two moths in New England due to causes other than the imported insect enemies.

A list of the literature cited, including 26 references, is included.

The Pandora moth, a periodic pest of western pine forests. J. E. PATTERSON (*U. S. Dept. Agr., Tech. Bul.* 137 (1929), pp. 20, figs. 8).—This is a report of studies of a moth enemy (*Coloradonia pandora* Blake) of pine forests in certain areas of the West, which during the years from 1918 to 1925 severely defoliated thousands of acres of merchantable yellow pine on the Klamath Indian Reservation and adjoining timbered tracts in southern Oregon. It attacks only pines, western yellow pine (*Pinus ponderosa*) and Jeffrey pine (*P. jeffreyi*) being its principal hosts, although lodgepole pine (*P. murrayana*) is sometimes attacked. Its range is known to cover the Pacific States, and specimens have been collected in Colorado and Montana. Its primary injury is to the tree, which results directly from the loss of needles, and the secondary injury results from the weakened condition of the tree, which renders it susceptible to bark beetle attack. The bark beetle attacks in stands of pine defoliated by the moth have resulted in far greater damage than the primary damage of the defoliator. Infestations of the western pine beetle and the mountain pine beetle have shown an abnormal increase in the defoliated areas studied.

The life cycle of *C. pandora* covers a period of two years. The eggs are deposited on the bark and foliage of trees and bushes, and sometimes on ground litter. Following an incubation period of approximately 40 days, the larvae hatch out and feed the first summer in colonies upon the needles of the terminal shoots and, when winter sets in, hibernate in clusters at the base of the needles. When feeding is resumed the following spring, large quantities of needles are consumed and the greatest damage is suffered by the host. Pupation begins in June of the second year and takes place in the ground from 1 to 5 in. below the surface. The pupal stage covers one full year, the species passing the second winter as pupae in the ground. The caterpillars are subject to a wilt disease similar in general manifestations to the gipsy-moth wilt. Ground squirrels eat large numbers of the pupae, and birds prey upon the caterpillars. It is attacked by three hymenopterous parasites and one dipteran.

While no direct efforts have been made to control this moth, it is thought that it may be held in check during incipient stages of its attack by the airplane application of arsenicals.

Life history of the oriental peach moth in Georgia, O. I. SNAPP and H. S. SWINGLE (*U. S. Dept. Agr., Tech. Bul. 152 (1929), pp. 16, figs. 3*).—This is a report of studies of the oriental fruit or peach moth (*Laspeyresia molesta* Busck) at Fort Valley in the Georgia peach belt. The pest was first recorded in the Southern States from Valdosta, Ga., in the fall of 1923, this locality being south of the Georgia peach belt. In the summer of the same year suspicious injury was observed on peach trees in the town of Fort Valley, Ga., in the center of the peach belt, and in 1924 larvae were collected in twigs from these same trees. Its life history was studied at Fort Valley during 1925 and 1926, the results of which are here presented. Parasites of the pest have been found very scarce at Fort Valley, only three species having been taken, namely, the dipteran *Lixophaga variabilis* Coq. and two species of Hymenoptera of the genera *Apanteles* and *Eubadizon*.

The pest has not been and is not now of any economic importance in the central Georgia peach belt, and it is thought that it never will be of major importance in that section unless fruit that matures late in the season is planted. It is pointed out that the harvest of the Elberta, the latest commercial variety of peach, is usually completed in central Georgia before the last three broods of the fruit moth have been produced. As a result of the absence of a host after midsummer and the hardened condition of the peach twigs there is an apparent heavy mortality of larvae of broods that would otherwise hibernate. Attention is called, however, to the fact that in the northern part of the Georgia peach belt considerably heavier infestations have been reported by C. H. Alden of the Georgia State Board of Entomology, and that the insect is likely to become of considerable economic importance there. In that section apples are raised, and the later broods of the larvae are able to mature in the fruit and hibernate in sufficient numbers to injure peaches seriously the following season.

Much of the data is presented in table and chart form.

Studies on the fall army worm in the Gulf Coast district of Texas, R. A. VICKERY (*U. S. Dept. Agr., Tech. Bul. 138 (1929), pp. 64*).—This report of studies of the fall army worm in Texas deals with the nature of its injury to corn, its food plants, life history and habits, seasonal history, parasites, and the cause of outbreaks.

The greater part of the work (pp. 15-60) deals with its parasites, studies of which are reported upon at length. The pest was found to pass through as many as 11 generations a year at Brownsville, Tex. Its parasites were numerous at Brownsville, 20 species having been observed. With one exception they were found to have other hosts and not to be limited exclusively to the fall army worm. During April, May, and June between 40 and 50 per cent of the caterpillars feeding on corn at Brownsville are destroyed by parasites in the early stages.

Hieroxestis subcervinella Wlk., an enemy of the banana in the Canary Islands, J. N. OLDHAM (*Bul. Ent. Research, 19 (1928), No. 2, pp. 147-166, pls. 2, figs. 15*).—This is a report of studies conducted with a moth which has recently become a pest of economic importance to banana cultivators in the Canary Islands. Its economic importance is considered in relation to its host plants.

The British gall midges of peas, H. F. BARNES (*Bul. Ent. Research, 19 (1928), No. 2, pp. 183-185, figs. 2*).—This contribution from the Rothamsted Experimental Station includes a description of a new species of gall midge—an inquiline—found on pea pods in Harpenden in late July and early August under the name *Olinodiplosis pisicola* n. sp.

[Mediterranean fruit fly] (*Calif. Dept. Agr. Mo. Bul.*, 18 (1929), No. 7, pp. 373-419, figs. 13).—The following contributions relating to the Mediterranean fruit fly are included in this number: Mediterranean Fruit Fly, by C. C. Young (pp. 378, 379); Preliminary Report of Observations on Mediterranean Fruit Fly Situation in Florida, by D. B. Mackie (pp. 380-385); California Prepares to Prevent Fruit Fly Invasion, by A. C. Fleury (pp. 386-389); The Mediterranean Fruit Fly, by H. J. Quayle (pp. 390-392); Quarantine and Patrols, by J. P. Coy (pp. 393-396); Public Relations and Organization, by A. A. Brock (pp. 397-399); Surveys of Entire Area in Florida, by H. J. Ryan (pp. 400-402); Inspection Work for Fruit Fly in Florida, and How Carried Out, by A. H. Call (pp. 403-405); Disinfection as Applied in the Fruit Fly Area, by A. E. Bottel (pp. 406-408); Development of Equipment and Destruction of Fruit, by P. V. Harrigan (pp. 409-412); Hosts of the Mediterranean Fruit Fly in Florida, by R. R. McLean (pp. 413-417); Spread of the Fruit Fly, by T. D. Urbahns (pp. 418, 419), etc.

Surra in Mauritius and its principal vector, *Stomoxys nigra*, A. MOUTIA (*Bul. Ent. Research*, 19 (1928), No. 2, pp. 211-216).—This is an account of the only blood sucking fly of common occurrence in Mauritius. Its transmission of surra is direct, occurring when flies take a meal on a surra-infected animal with trypanosomes in the peripheral blood, and immediately afterwards feed on a healthy animal.

The sheep blow-flies of South Africa, B. SMIT (*Union So. Africa Dept. Agr. Bul.* 47 (1929), pp. 27, pls. 4, figs. 12).—This is a summary of information on the sheep blowflies of South Africa, which includes full-page colored illustrations of *Chrysomya chloropyga*, *Lucilia sericata*, and *C. albiceps*.

Fleas found on rodents and insectivores in Nigeria, A. S. PEABSE (*Bul. Ent. Research*, 19 (1928), No. 2, pp. 167-169).—Details of the author's findings are presented in tabular form.

A study of *Colaspis hypochlora* Lefèvre, G. SALT (*Bul. Ent. Research*, 19 (1928), No. 3, pp. 295-308, fig. 1).—This is an account of studies of the beetle *C. hypochlora*, the attack of which causes a scarring of the skin of banana fruit in the banana-producing area of northeastern Colombia and in certain parts of Central America.

The control of the apple curculio by hogs, B. B. FULTON (*Iowa Sta. Circ.* 117 (1929), pp. 4, figs. 2).—This is a practical account of the control of the apple curculio by the use of hogs, detailed accounts of which have been noted (*E. S. R.*, 59, pp. 255, 256).

Biology of the cotton boll weevil at Florence, S. C., F. A. FENTON and E. W. DUNNAM (*U. S. Dept. Agr., Tech. Bul.* 112 (1929), pp. 76, figs. 36).—This is a report of work conducted at Florence, S. C., during a period of three years, in cooperation with the Pee Dee Substation of the South Carolina Experiment Station. Following an introductory account of the cotton boll weevil and the rainfall and temperature in the Pee Dee district, the authors deal with the relation of climate to boll weevil biology at Florence, damage caused by the boll weevil, seasonal history studies of 1924, 1925, and 1926, life cycle in field cages, life cycle in the insectary, comparison between life cycles in the field cages and in the insectary, influence of food on the biology of the weevil, the comparative biology of fall-mated and spring-mated weevils, dispersal, hibernation, and natural control.

There was found to be a maximum of four generations a year, the first two being large while the third and especially the fourth were incomplete. The average longevity of overwintered weevils in hibernation cages before cotton was available for food was 5.65 days. In the late fall weevils were found to live as long as 29 days without food or water. In field cages the average

length of life before square formation was 8.13 days and after square production it was 19.32 for males and 15.99 for females. The maximum longevity was 82 days for males and 81 for females. In these same cages the preoviposition period averaged 7.21 days, the oviposition period 12.66 days, the average number of eggs deposited per female 81.21, and the daily rate of egg deposition 6.42. The maximum fecundity in field cages was 440 eggs. The average period of development in squares in the field was 18.3 days and in bolls 32.31 days.

The average winter survival in 1925 and 1926 was 3.17 per cent in field cages and 4.31 per cent in the woods. The shelter giving the most protection was piled cotton stalks, in which the survival was 5.64 per cent, followed by 4.03 in cornstalks, 3.56 in fine straw, 2.63 in Spanish moss, 1.37 in sawdust or shavings, 0.72 in oat straw, and 0.43 in cage only.

The migration of overwintered weevils to cotton after emergence, as determined by means of trap crops, showed that in 1925 large numbers migrated to cotton from May 14 to June 22. Field counts made in 1925 likewise showed that overwintered weevils continued to enter cotton fields during June.

Six species of parasites were reared, as follows: *Microbracon mellitor* (Say), *Catolaccus hunteri* Cwfd., *Eurytoma tylodermatis* Ashm., *Eupelmus cyaniceps* var. *amicus* Gir., *Triaspis curculionis* Fitch, and *Zatropis incertus* Ashm. Among these *M. mellitor* was the most numerous and important.

The Sirex wood-wasps and their importance in forestry. R. N. CHRYSTAL (*Bul. Ent. Research*, 19 (1928), No. 3, pp. 219-247, pls. 3, figs. 10).—The author gives a complete review of the classification and status of the siricid wood wasps occurring in Britain. The biology of *S. cyaneus* F., which has been studied at Tubney Wood, Oxford, during the past two years, is described, together with supplementary notes on *S. gigas* L.

"A study of the forest relations of *S. cyaneus* at Tubney has shown that this species can not be considered a primary enemy of healthy green trees. Trees which are favored by Sirex are usually markedly unhealthy from one cause or another. At Tubney unsuitable soil conditions were the principal factors. Sirex and *Tetropium gabrieli* Weise, the larch longicorn beetle, may occur almost simultaneously as indicators of pathological conditions in larch woods. In North Devon *Fomes annosus*, a root fungus, was the predisposing factor in the case of silver fir attacked by Sirex. Both *S. cyaneus* and *S. gigas* may occur in the same tree. This was found to be the case at South Molton, North Devon, in silver fir. *S. gigas* appears to prefer larger trees, and it is not present in the larch at Tubney Wood, which is in the pole stage. The primary object of the work was to acquire a knowledge of the parasites of Sirex. *Rhyssa persuasoria* L. and *Ibalia leucospoides* Hochenw. Both parasites were studied at Tubney, and have already been dealt with [*E. S. R.*, 60, p. 252].

"It is considered probable that the results obtained in the above study will throw some light on the Sirex problem in New Zealand. Emphasis is therefore laid upon the importance of studying the silvicultural conditions in relation to Sirex attack."

A revision of the Indo-Australian species of the genus Apanteles (Hym. Bracon.). Part II, D. S. WILKINSON (*Bul. Ent. Research*, 19 (1928), No. 2, pp. 109-146, fig. 1).—In this second part of the revision previously noted (*E. S. R.*, 60, p. 252), 36 additional species of parasites of the genus *Apanteles* are dealt with, of which 18 are described as new. A list is given of 8 additional species unknown to the author or otherwise of doubtful position. A key to the species, a host list, and an index to the species dealt with in the two parts are included.

Notes on some chalcid parasites of lac-insects, C. FERRIERE (*Bul. Ent. Research*, 19 (1928), No. 2, pp. 171-176, figs. 3).—Four parasites that are injuri-

ous because of their attack upon the lac insects are considered, of which three are described.

Two new parasites of *Tirathaba rufivena* Walk. in Malaya, D. S. WILKINSON (*Bul. Ent. Research*, 19 (1928), No. 2, pp. 201, 202).—Under the names *Nemeritis palmaris* n. sp. and *Apanteles tirathabae* n. sp., the author describes two parasites of the pyralid moth *T. rufivena*, which is proving to be one of the important minor pests of the coconut in the Federated Malay States.

A new encyrtid (Hym., Chalcid.) bred from *Clastoptera* (Hom., Cercop.), J. WATERSION (*Bul. Ent. Research*, 19 (1928), No. 3, pp. 249–251, fig. 1).—Under the name *Carabunia myersi* n. g. and sp. the author describes a parasite reared from the nymph of *Clastoptera* sp. on *Acalypha wilkesiana* Müll. in Soledad, Cuba, by J. G. Myers. The rate of parasitism was so high that the investigator failed to rear a single adult of the *Clastoptera*. He proposes to introduce the parasite into Trinidad in the hope that it may attack the sugarcane frog hopper (*Tomaspis saccharina* Dist.).

The incidence of a fungal parasite of scale insects in New Zealand, J. G. MYERS (*Bul. Ent. Research*, 19 (1928), No. 2, p. 181).—This is a brief account of the host relations of the New Zealand form of *Aegerita webberi* Fawcett, recorded as attacking *Aleyrodes citri* in Florida, *Aleyrodes* and *Aspidiotus* in Ceylon, and an undetermined scale in New Zealand.

Two species of gall-mites (Eriophyidae) of the lilac (*Syringa vulgaris* L.) new to Britain, A. M. MASSEE (*Bul. Ent. Research*, 19 (1928), No. 3, pp. 259, 260, pl. 1).—*Eriophyes louri* and *Phyllocoptes massaiongoi*, both of Nalepa, here described, are sources of injury to the lilac in East Malling and Sevenoaks, Kent.

An eriophyid mite on apple, A. M. MASSEE (*Bul. Ent. Research*, 19 (1928), No. 2, pp. 203, 204, fig. 1).—An account is given of *Phyllocoptes schlechtendali* Nal., which attacks and frequently causes leaves to fade and become bleached in Sevenoaks, East Malling, and various localities in Sussex.

The bionomics of the bulb mite, *Rhizoglyphus echinopus* Fumouze & Robin, W. E. H. HODSON (*Bul. Ent. Research*, 19 (1928), No. 2, pp. 187–200, pls. 3).—The observations and experiments here reported are considered to indicate clearly that *R. echinopus* is not a primary pest of the narcissus. At the same time there is every indication that this mite does bring about the destruction of bulbs, damaged by other organisms or by mechanical means, which would normally recover from their original injuries. Further, the mites can undoubtedly carry fungus spores from bulb to bulb.

The cattle tick pest and methods for its eradication (*Aust. Council Sci. and Indus. Research Pamphlet 12* (1929), pp. 23).—Following an introduction (p. 5), the subject is dealt with under the headings of the cattle tick pest (pp. 6–8), tick infestation (p. 9), tick fever (pp. 9–14), and methods for eradication (pp. 14–23).

ANIMAL PRODUCTION

Commercial feeds in Kentucky in 1928, J. D. TURNER, H. D. SPEARS, W. G. TERRELL, and L. V. AMBURGEY (*Kentucky Sta. Bul.* 295 (1929), pp. 205–233).—A summary of the results of official inspection and analyses of feeding stuff samples, collected during 1928, giving the manufacturer's name, kind of feed, and number of samples equal to or below their guaranty (E. S. R., 60, p. 253).

Inspection of commercial feeding stuffs, 1929, T. G. PHILLIPS, T. O. SMITH, and F. S. SCHLENKER (*New Hampshire Sta. Bul.* 245 (1929), pp. 59).—The usual report of the guaranteed and found analyses of samples of 397 brands of feeding stuffs collected for official inspection for the year ended May, 1929 (E. S. R., 61, p. 59).

[Investigations with beef cattle at the Illinois Station] (*Illinois Sta. Rpt. 1929, pp. 59-69, 75, 76*).—The results of experiments, most of which are continuations of work previously reported by H. P. Rusk and R. R. Snapp (*E. S. R., 60, p. 254*), are noted.

Takes longer to finish beef on ear corn silage.—Steer calves fattened on ear corn silage required at least 30 days more feeding to attain the same degree of finish as calves fattened on shelled corn. The latter calves were considered finished after 214 days' feeding. Adding a limited amount of alfalfa hay to the ear corn silage ration increased the rate of gain and the return over feed cost, but adding bone meal decreased the consumption of silage, thus decreasing the efficiency of the ration.

General cattle feeding practice may be wrong—A group of 4 calves receiving a ration containing 33.33 per cent of cottonseed meal were continued on this feed until they had eaten approximately 5 lbs. of cottonseed meal per day for 315 days without showing any harmful effects. They made average daily gains of 2.29 lbs. per head as compared with 1.59 lbs. for a group of steers fed no nitrogenous supplement during the same period. During the first half of the feeding period the calves fed no cottonseed meal gained only 53 per cent as much as the calves receiving cottonseed meal, but during the latter half they gained 95 per cent as much. The calves receiving no cottonseed meal ate 38 per cent more grain during the first half and 5 per cent more during the second half of the feeding period than did the calves receiving cottonseed meal. It is thought that these results may indicate a greater need for nitrogenous concentrates during the early part of a feeding period.

An examination of the kidneys of the cottonseed meal-fed steers slaughtered several months after the close of the test showed two or three areas of pinpoint hemorrhages on the kidneys of one steer, but in other respects the kidneys appeared normal. Microscopic studies, however, revealed a condition that indicated primarily inflammatory changes.

Scabby barley utilized for fattening steers.—During an 84-day feeding period, 2-year-old steers fed native barley carrying a 47 per cent infection of scab gained at the rate of 2.81 lbs. per head daily as compared with 3.08 lbs. for similar steers fed shelled corn. A grain ration composed of half barley and half corn produced gains of 3.16 lbs. daily, as did also a grain ration consisting of corn, barley, and oats, 50 : 25 : 25. The feed cost per 100 lbs. of gain was highest in the shelled corn lot and lowest in the lot receiving the half-and-half grain ration, with little difference in the cost of the other two lots. The dressing percentage was highest in the shelled corn lot and lowest in the barley lot.

Steers fed this barley on bluegrass pasture gained at the rate of 2.89 lbs. per head daily while those fed shelled corn gained 2.63 lbs. The cost of gain was nearly 50 per cent higher in the corn-fed lot than in the barley lot. The steers fed corn dressed about 1 per cent higher than those fed barley.

Illinois 1928 barley inferior to northern grain.—In this study two lots or 2-year-old steers were fed a ration of cottonseed meal, alfalfa hay, and corn silage, and in addition lot 1 received No. 4 Illinois barley carrying a 47 per cent scab infection, and lot 2 received No. 1 disease-free northern-grown barley. The average daily gains were 2.81 and 3.35 lbs. per head in the respective lots for an 84-day period. The cost of feed was 50 cts. per hundredweight less in the lot receiving the home-grown barley, but this lot dressed about 2 per cent less than the lot receiving the northern barley. Although the native barley gave satisfactory results, it was evident that the scab infection at least partially reduced its feeding value.

Silo promises relief from oats crop problems.—A ration of shelled corn, cottonseed meal, and alfalfa hay, to which was added either corn silage or oat silage, was fed to two lots of 2-year-old steers for 84 days. It was estimated that each ton of oat silage contained the equivalent of 13 bu. of threshed oats and 550 lbs. of straw, and that each acre harvested for oat silage produced 4.89 tons of silage. The average daily gains were 3.08 lbs. per head in the lot receiving corn silage and 2.88 lbs. per head in the lot receiving oat silage. While the gains produced on oat silage were not as rapid nor as economical as those produced on corn silage, the value of oat silage lies in its lower production cost and in the salvaging of badly lodged grain.

Stover silage inferior for wintering beef calves.—During a winter period of 133 days, beginning December 22, two lots of 24 calves each, averaging 463 lbs. per head, were fed 1 lb. of cottonseed meal and 2 lbs. of mixed hay daily. In addition lot 1 received stover silage and lot 2 normal corn silage. The average daily gains were 0.65 and 1.16 lbs. per head, respectively. The total feed cost per head was \$10.15 for lot 1 and \$15.22 for lot 2, but the cost of feed per 100 lbs. of gain was \$11.67 and \$9.85, respectively. While the stover silage was quite palatable and the calves receiving it remained healthy and thrifty throughout the test, it did not produce good gains and the calves were thinner in flesh at the end of the test than when put on feed. On normal corn silage the calves improved in condition as the feeding period lengthened.

Measure effect of high-protein rations on steers.—In this study Rusk, H. H. Mitchell, and T. S. Hamilton determined the basal metabolism of 7 steers which had been raised on rations with nutritive ratios of either 1 : 4.3 or 1 : 10.9. As a whole the results indicate that the higher the level of protein metabolism, induced by varying levels of protein feeding, the higher was the fasting heat production of the steer.

Heavy feeding more wasteful than light feeding.—Mitchell, Hamilton, F. J. McClure, J. R. Beadles, W. T. Haines, and H. P. Morris fed an experimental ration in which ground corn provided on the average 73.9 per cent of the dry matter, cut alfalfa 23.9 per cent, linseed oil meal 2 per cent, and molasses 0.8 per cent at five different levels, starting at a very high level and gradually decreasing. It was found that the digestibility of the dry matter, nitrogen-free extract, and ether extract increased with each decrease in the amount of feed given, while the digestibility of the protein and crude fiber varied irregularly. The average heat production corrected to constant body weight and to a 12-hour day in both the standing and lying positions decreased from the highest level in the following order: 19,854, 16,892, 15,111, 13,400, and 10,212 calories. The fasting heat production averaged 9,394 calories at a constant body weight of 629 kg. This decrease in heat production with each decrease in feed represents a lessened wastage of feed energy as animal heat.

The metabolizable energy increased with each decrease in the feed, due to increased digestibility. From the highest to the lowest level of feeding, 65 per cent of the metabolizable energy consumed was available as net energy in period 1, 69.2 per cent in period 2, 69.9 in period 3, 70.8 in period 4, and 90 per cent in period 5.

Beef cattle investigations, 1928-29 (Kansas Sta., Fort Hays Substa. [Pamphlet], 1929, pp. [2-7]).—The results of two experiments are noted in continuation of those previously reported (E. S. R., 60, p. 854.)

I. The comparative value of roughage fed in different forms.—To compare the feeding value of kafir fodder, kafir stover, and kafir hay fed in different forms as roughages for stock cattle, 10 lots of 10 yearling steers each averaging approximately 676 lbs. per head were fed for 150 days. Cottonseed cake was fed at the rate of 1 lb. per head daily in each lot. In addition the first 4 lots

received kafir fodder either whole, chopped, ground, or as silage, the next 4 lots kafir stover either whole, chopped, ground, or as silage, lot 9 whole kafir hay, and lot 10 ground kafir hay. The average daily gains were 1.07, 0.95, 1.43, 1.47, 0.27, 0.14, 0.39, 0.78, 0.94, and 1.17 lbs. per head, respectively.

The average gain produced by the roughage fed from 1 acre when supplemented with cottonseed cake was 156.11, 150.9, 249.58, 394.75, 16.4, 9.71, 31.59, 135.11, 226.49, and 269.93 lbs. per head in the respective lots. These results show that chopping either kafir fodder or stover reduced the gains as compared with the whole plant, while grinding materially increased the gains. Kafir fodder or stover in the form of silage was much more efficient in producing gains than any of the other forms. The ground kafir hay produced more efficient and economical gains than the whole hay.

II. *The value of adding calcium carbonate in the form of finely ground limestone to a stock cattle ration consisting of silage and cottonseed meal.*—In this study 3 lots of steer calves averaging approximately 454 lbs. per head were fed for 122 days. The basal ration in lot 1 consisted of kafir silage, cottonseed meal, and salt. To the basal ration in lot 2 was added 0.1 lb. of ground limestone, and in lot 3 0.025 lb. of ground limestone per head per day. The average daily gains in the respective lots were 1.08, 1.15, and 1.25 lbs. per head, a difference in rate of gain not deemed significant. In the ration fed, the leaves and stalks of the kafir plant supplied a rather large amount of calcium to meet the normal body requirements. It is suggested that when a ration is fed in which the amount of roughage supplied is small and the grain allowance large, a supplement of ground limestone may be advisable.

[Factors affecting the quality of meat] (*Illinois Sta. Rpt. 1929, pp. 69-75, fig. 1*).—The results of several tests are noted in continuation of those previously reported (*E. S. R.*, 60, p. 253) by S. Bull, F. C. Olson, H. H. Mitchell, and T. S. Hamilton.

Compare quality of beef from barley and corn.—Slaughter weights, dressing percentages, carcass grades, percentage of fat in the ribs, and the refractive index and the iodine number of the rib fat were obtained for 10 2-year-old steers that had been fed barley and 10 similar steers fed corn. There was no significant difference in the dressing percentages of the two lots of cattle. Barley feeding produced 8 good and 2 medium carcasses, while corn feeding produced 1 choice, 6 good, and 3 medium carcasses. Although only 1 steer was finished, there were indications that the barley-fed animals had attained a slightly better finish than the corn-fed animals. No difference in the firmness of fat was determined either by the refractive index or the iodine number tests. As measured by the spectrophotometer, the color of the twelfth rib showed the lean of the barley-fed steers to be better than that of the corn-fed steers. The average hemoglobin content of the rib eye of the corn-fed steers was 0.325 and of the barley-fed steers 0.291.

Determine time required to make high quality beef.—Calves fed shelled corn, cottonseed meal, silage, and alfalfa hay were slaughtered at varying intervals during the feeding period. The dressing percentage gradually increased as the length of the feeding period increased. Calves slaughtered after 112 and 147 days of feeding were decidedly unfinished. One steer killed after 182 days was finished, but the other slaughtered at this date was not. Only 1 of the 14 steers killed after 214 days of feeding was decidedly unfinished, and 2 were slightly underfinished.

The dressing percentages of calves fed ear corn silage were practically the same after 214 days of feeding as the calves fed shelled corn, and 31 days' further feeding did not improve these percentages. At 214 days 2 of the 10 calves slaughtered were decidedly unfinished, and 3 were slightly unfinished,

At 245 days only 1 of 5 calves was distinctly unfinished. These results indicate that calves receiving ear corn silage required 31 days more feeding to put on the same degree of finish as calves fed shelled corn.

A chemical analysis of the ninth, tenth, and eleventh ribs of the steers fed shelled corn showed no effect either of age or condition on the iron or the connective tissue of the eye of beef. Marbling appeared to increase up to at least 182 days of feeding. The fat content of the separated fat from the ribs did not increase after 147 days of feeding, and the fat content of the total boneless meat increased up to 182 days of feeding.

Imperfect bleeding causes poor color of beef.—In this study one lot of 10 2-year-old steers was slaughtered by knocking and bleeding immediately, a second lot of 5 similar steers by knocking and bleeding five minutes later, and a third lot of 5 steers by the kosher method. The color of meat from the ninth, tenth, and eleventh ribs of the first and third lots was good for mature beef, while in the second lot the meat from 3 steers had a very poor color. The hemoglobin content of the meat was 0.291, 0.293, and 0.316 per cent in the respective lots.

Improved reindeer handling, L. J. PALMER (*U. S. Dept. Agr. Circ. 82 (1929), pp. 18, figs. 2*).—With the increase in the number of Alaskan reindeer it has been found necessary to improve the methods of handling them. In this publication methods of management, feeding, breeding, and butchering which have been successfully adopted within recent years are discussed.

[*Experiments with lambs at the Illinois Station*] (*Illinois Sta. Rpt. 1929, pp. 97-99*).—The results of two experiments by W. G. Kammlade are reported.

Suckling lambs gain well on little grain feed.—A grain ration of 20 lbs. of ground corn, 20 lbs. of whole oats, 10 lbs. of bran, and 10 lbs. of linseed oil meal was fed to 2 lots of western lambs, a third lot receiving the same ration with the bran omitted, and a fourth lot a mixture of 25 lbs. of ground corn and 25 lbs. of whole oats. The roughage ration in the respective lots was 40 lbs. of ground clover hay, 40 lbs. of ground alfalfa hay, 50 lbs. of ground clover hay, and 50 lbs. of ground alfalfa hay. During an 84-day feeding period lot 1 gained 31 lbs. per head and consumed on the average 33 lbs. of grain and 22 lbs. of hay. In lot 2 the lambs gained 35 lbs. per head, but ate 19 lbs. more grain and 12.7 lbs. more hay than lot 1. The rations fed lots 3 and 4 were not so satisfactory as those fed lots 1 and 2, although the gains were but slightly smaller.

Western lambs make faster gains on ground feed.—Choice feeder lambs that had been on pasture for 28 days were divided into 6 lots of 25 head each, averaging approximately 61 lbs. per head, and fed in dry lot for 80 days. The following rations were fed in the respective lots: Shelled corn and alfalfa hay, ground corn and ground alfalfa hay, Illinois barley and alfalfa hay, northern barley and alfalfa hay, ground Illinois barley and ground alfalfa, and ground corn and ground Illinois barley, equal parts, plus ground alfalfa. The rations were hand-fed in lots 1, 3, and 4, and were mixed and self-fed in the other lots. The average daily gains during the feeding period were 0.31, 0.36, 0.29, 0.3, 0.37, and 0.32 lb. per head, respectively. Based on feed required per 100 lbs. of gain, lot 1 made the most efficient use of its ration and lot 6 the least efficient use. There was little difference in the efficiency of the other rations, with the possible exception of lot 4, which had a slight advantage in this respect. The shrink in shipping was 4.1, 3.2, 5.2, 2.7, 7.2, and 2.8 per cent in the respective lots.

Some comparisons of methods of fattening western lambs, W. G. KAMMLADE (*Illinois Sta. Bul. 338 (1929), pp. 20*).—This is a more detailed account of work noted elsewhere (*E. S. R.*, 56, p. 367; 58, p. 356; 60, p. 257; and above).

Type of feeder lamb, W. L. HENNING (*Pennsylvania Sta. Bul. 243 (1929), p. 12*).—In this study 6 lots of 26 lambs each were fed for 76 days. Lots 1 and 2 were native fine wool lambs, lots 3 and 4 native mutton lambs, and lots 5 and 6 western black face range lambs. The ration fed in lots 1, 3, and 5 consisted of shelled corn, linseed oil cake (pea size), mixed hay, and corn silage. In lots 2, 4, and 6 the same ration, with the exception of silage, was fed. The average daily gains were 0.16, 0.15, 0.15, 0.25, 0.23, and 0.32 lb. per head in the respective lots.

[**Experiments with swine at the Illinois Station**] (*Illinois Sta. Rpt. 1929, pp. 83-92, figs. 2*).—The results of experiments, most of which are continuations of work previously reported (*E. S. R., 60, p. 258*), are noted.

Study two more supplements to swine rations.—W. E. Carroll, G. E. Hunt, and H. H. Mitchell fed 10 pairs of pigs on a ration of yellow corn, soybean oil meal, linseed meal, and alfalfa meal, to each 100 lbs. of which was added 1 lb. of calcium carbonate and 0.5 lb. of salt. One pig of each pair received 3 gm. of ferric citrate in aqueous solution poured over the feed once each day. The check pig in all pairs but one made more rapid and economical gains than the one receiving ferric citrate.

A similar ration in which tankage replaced soybean oil meal was fed to 13 pairs of pigs, and the calcium carbonate was also omitted. One pig in each pair received enough of a solution of potassium iodide poured over the feed to supply it with 1 grain of elemental iodine daily. In seven of the pairs the check pigs gained more rapidly and economically, while the reverse was true with the other pairs. However, there was no great difference in the rate or economy of gains.

Iron supplements increase blood hemoglobin in swine.—Iron citrate added to the ration of one pig in each of seven pairs was found to increase on the average the blood iron by 9.4 per cent and the red cells by 11.9 per cent over the check pigs. However, since the check pigs were not anemic it is doubtful whether any benefit was derived from feeding iron citrate.

Study prevention of pig anemia.—In this study by T. S. Hamilton and Hunt, a litter of pigs farrowed in a barn were moved to cindered yards outdoors on the seventh day. At birth the blood hemoglobin of these pigs ran from 11 to more than 15 gm. per 100 cc. of blood. This fell to about 8 gm. during the first week and still lower the second. At this time the blood hemoglobin began to increase and reached levels approximating those at birth, and at the same time the body weight increased rapidly. A second litter kept indoors showed the same initial decline as the first litter, but apparently there was no recovery and the hemoglobin reached the low level of 3 to 4 gm. per 100 cc. The mother of a third litter was fed 750 mg. of iron citrate and 191 mg. of copper sulfate for 12 days before farrowing, while a fourth sow received no treatment. Half of the pigs in each of these last two litters received 25 mg. of iron citrate and 5 mg. of copper sulfate daily, while the other pigs were untreated. The additional feeding of the mother of the third litter did not benefit the pigs to any extent. The treated pigs in these litters responded favorably to the additional feeding, but the untreated pigs developed anemia.

Food needs of pregnant swine measured in tests.—Weights taken on uteri, fluids, membranes, and fetuses of 16 pregnant gilts, slaughtered for examination between the fifth and sixteenth week of pregnancy, by Mitchell, Hamilton, Carroll, and Hunt indicated that the pregnant uterus increases in size to 15

or 17 times that the nonpregnant uterus in 12 weeks of gestation, that the amniotic fluid increases in weight to the eighth week of gestation and then varies irregularly, that the fetal membranes attain their maximum weight at the ninth week, and that fully two-thirds of the fetal weight is developed in the last 4 weeks of gestation. It was found that from insignificant changes at the start of gestation, the pregnant uterus at the end of the sixteenth week was increasing in weight at the rate of 312 gm. per day and was retaining 33 gms. of protein, 272 calories of energy, 12 gm. of ash, 4.29 gm. of calcium, 1.98 gm. of phosphorus, and 12.3 gm. of iron per day.

Soybeans good supplement to brood-sow rations.—A ration of corn, tankage, and linseed meal was fed by Carroll and Hunt to a lot of 25 brood sows, while in a lot of 24 similar sows whole soybeans replaced the protein supplement fed in the first lot. This feeding was continued through both pasture and dry-lot feeding of pregnant and lactating sows. Enough beans were fed to provide the same amount of digestible crude protein as was supplied in the tankage-linseed meal mixture. During the winter alfalfa meal was added to both rations, and a mineral mixture was available at all times.

There was no appreciable difference in the rate of gain of the sows in the two lots, but during the gestation period the soybean-fed sows consumed somewhat less feed per unit of gain than the check sows. In the check lot the average litter size at farrowing time was 10.1 pigs, the average number weaned 6.1, the average birth weight 2.66 lbs., and the average weaning weight 23.2 lbs. The corresponding figures for the soybean-fed sows were 9.5, 4.8, 2.74 lbs., and 26.3 lbs. While these figures probably do not represent any significant difference, they do show that when properly fed soybeans make an excellent supplement to corn for brood sows.

No "hard pork" combination of soybeans found.—S. Bull, F. C. Olson, and Carroll found that of 9 pigs fed a ration of 90 per cent of corn and 10 per cent of tankage, 7 produced hard and 2 medium-hard carcasses. On a ration of 85 per cent of corn and 15 per cent of soybeans, 8 pigs produced soft carcasses. Of the 8 carcasses in a lot fed 85 per cent of corn and 15 per cent of soybeans to 165 lbs. of live weight and then finished on corn and tankage, 5 were soft and 3 medium soft. On a ration of 90 per cent of corn and 10 per cent of tankage to 115 lbs. and then finished on 85 per cent of corn and 15 per cent of soybeans, 7 pigs produced soft carcasses and 3 medium soft.

Still seeking way to use soybeans for swine.—In this study by Bull, Olson, Carroll, and Hunt, 6 lots of 10 pigs each were fed rations composed of 90 per cent of either ground corn or ground barley and 10 per cent of tankage; 80 per cent of either ground corn or ground barley and 20 per cent of ground soybeans; 85 per cent of ground barley and 15 per cent of ground soybeans; and 42.5 per cent of ground barley, 42.5 per cent of ground corn, and 15 per cent of ground soybeans. All lots received 1 lb. of alfalfa meal in each 20 lbs. of grain mixture until they reached an average weight of 125 lbs. when the allowance was changed to 1 lb. per 50 lbs. of grain mixture, and in addition all lots had access to a mineral mixture. The hogs were slaughtered as they reached 225 lbs. in weight, and the carcasses measured, graded for firmness, and the refractive index and iodine number of back-fat samples determined. In lot 1, 8 finished pigs gained at the rate of 1.6 lbs. per day and graded 5 hard and 3 medium-hard carcasses. The number of finished hogs in the remaining lots were 10, 7, 2, 5, and 5, which made average daily gains of 1.6, 1.3, 1.2, 1.3, and 1.3 lbs. per head daily, and whose carcass grades were 8 hard and 2 medium hard, 3 soft and 4 oily, 1 soft and 1 oily, 5 soft, and 4 soft and 1 oily, respectively.

The study of fattening rations for swine in dry lot, M. F. GRIMES (*Pennsylvania Sta. Bul. 243* (1929), p. 13).—Continuing these studies (E. S. R., 60, p. 363), 6 lots of 11 pigs each were fed for 70 days as follows: Corn and tankage, 12:1; corn, ground oats, wheat middlings, and tankage, 4:3:2:1; corn and oil cake, 12:1.7; corn, tankage, and oil cake, 12:¾:¼; corn, Palmo Midds, and tankage, 9.5:2.5:1; and corn, Palmo Midds, and tankage, free choice. The average daily gains in the respective lots were 1.32, 1.34, 1.24, 1.4, 1.13, and 1.7 lbs. per head. The consumption of Palmo Midds in lot 6 was almost negligible.

The northern pig—its habits, breeding, and management, J. H. SHEPPERD (*North Dakota Sta. Bul. 230* (1929), pp. 123, figs. 41).—This publication includes a revision of work previously noted (E. S. R., 50, p. 67). The results of work in hogging-off field peas (E. S. R., 61, p. 763) are also incorporated. Observations of various habits of pigs, presented in popular manner, make up the bulk of the bulletin.

Anemia in suckling pigs, E. B. HART, C. A. ELVEHJED, H. STEENBOCK, G. BOHSTEDT, and J. M. FARGO (*Wisconsin Sta. Bul. 409* (1929), pp. 14, figs. 6).—The authors point out the enormous losses each year during the suckling stage of pigs, part of which is due to anemia. This deficiency is most common from three to six weeks of age, due to the fact that sow's milk is a poor blood builder, especially when the animals are kept in unnatural surroundings. Supplementing the sow's milk with iron and copper salts prevents anemia only when fed directly to the pigs, and has no effect when fed to the sow. For preventing anemia it is recommended that each pig be fed 1 teaspoon per day of a solution made by dissolving 3.6 oz. of iron sulfate (ferric) in 5 qt. of water.

[Experiments with poultry at the Illinois Station] (*Illinois Sta. Rpt. 1929, pp. 113–115, fig. 1*).—The results of two experiments are noted.

Mistake to feed extra mineral mixtures to chickens.—Chicks averaging 253 gm. each at 6 weeks of age were produced on a ration of yellow corn meal, soybean oil meal, wheat middlings, salt, and cod-liver oil, 60:20:13:1:2, supplemented with 2 parts of steamed bone meal and 2 parts of ground limestone, in work by L. E. Card. In contrast, chicks receiving the same ration supplemented with 4 parts of steamed bone meal weighed 212 gm., and those receiving 4 parts of ground limestone weighed 187 gm. at the same age. Bone analyses of the chicks at 8 weeks of age showed that as the percentage of steamed bone meal in the ration increased the percentage of ether extract and calcium in the bone decreased, as did also the weight of the chicks.

Good poultry rations supply blood-forming elements.—T. S. Hamilton, H. H. Mitchell, and F. Simpson fed 18 pairs of young birds, weighing from 1 to 1.5 lbs. each, a ration of 20 per cent each of ground yellow corn, ground whole wheat, ground whole oats, and soybean meal, 10 per cent of wheat bran, 5 per cent of ground alfalfa leaves, 4 per cent of steamed bone meal, and 1 per cent of salt. One bird in each of the first 6 pairs was given iron daily at the rate of approximately 0.01 per cent in the form of ferric citrate. In the second 6 pairs one bird received enough copper sulfate to furnish approximately 0.0025 per cent of copper, while one bird in each of the last 6 pairs received both iron and copper. The experimental ration was not improved in its growth-promoting, egg-producing, or blood-forming powers by the addition of either iron or copper, or both.

[Poultry experiments at the Pennsylvania Station] (*Pennsylvania Sta. Bul. 243* (1929), pp. 27, 28, fig. 1).—Results of experiments, most of which have been continued (E. S. R., 60, p. 364), are noted.

The confinement system of poultry management.—H. C. Knandel found that of the total number of Single Comb White Leghorn pedigreed eggs set 61.39 per cent were hatched, while a hatching percentage of 56.23 was obtained for the Barred Plymouth Rock pedigreed eggs. The mortality on 3,779 White Leghorn chicks to May 21 was 3.65 per cent, and of 1,698 Plymouth Rock chicks 3.36 per cent. This was the third successive season that all chicks were raised in confinement.

The hatching percentages of pullet eggs for the season of 1929 for White Leghorns, Plymouth Rocks, and Rhode Island Reds were 68.71, 51.14, and 65.3 per cent, respectively.

The inheritance of hatchability of eggs and livability of chicks.—In this study by E. W. Callenbach, the increase in percentage of hatchability of eggs set in 1929 over 1927 was 13.19 for White Leghorns and 21.43 for Plymouth Rocks.

The effect of various protein-carbohydrate ratios upon the mortality, growth, and condition of Single Comb White Leghorn chicks.—P. H. Margolf found that a liberal supply of protein increased the rate of metabolism, and that from the fourteenth to the twentieth week of age the protein-carbohydrate ratio for chicks should be wider than during the starting period. Low-protein rations led to feather pulling, tail picking, and cannibalism as early as the second or third week, and tail picking never ceased during the 39-week period of the test in the low-protein lots.

Effect of different levels of animal protein, supplied by dried skim milk, on egg production, hatchability of eggs, and condition of Single Comb White Leghorn and Barred Plymouth Rock pullets.—Dried skim milk was fed to 4 lots of 50 White Leghorn and 50 Plymouth Rock pullets each as the sole source of animal protein at 5, 10, 15, and 20 per cent levels by Knandel. During a 36-week period all groups of Leghorns had a satisfactory egg yield, the return above feed cost being highest in the 5 and 15 per cent level groups. No significant difference was found in the hatching percentage which varied from 75.6 to 80 of eggs in any of these lots. With the Barred Rocks the lots fed 10 and 15 per cent dried skim milk produced more eggs and had a greater return over feed cost than those fed at 5 and 20 per cent levels. The hatching percentage varied from 75.38 at the 5 per cent level to 59.24 at the 20 per cent level.

Feeding trials with laying hens, J. H. MARTIN and W. M. INSKO, JR. (Kentucky Sta. Bul. 294 (1929), pp. 173-203, figs. 9).—The results of three studies are reported in this publication.

In part 1 a comparison of varying percentages of meat scrap in the mash for supplementing milk (E. S. R., 58, p. 67) was made in 3 series of tests, using 6 lots of birds in each. A grain and mash ration was fed to all lots except lot 5, which received no mash. Sour skim milk was fed ad libitum to the first 4 lots, 1 lb. of granulated buttermilk per 25 birds in lot 5, and 0.5 lb. of granulated buttermilk per 25 birds in lot 6. Meat scrap was fed at the rate of 2.5 per cent in lot 1, 5 per cent in lot 2, 7.5 per cent in lot 3, and 10 per cent in lots 4 and 6. The 3-year average egg production was highest in lots 1 and 3 and smallest in lot 5. The winter egg production in all lots was proportional to the yearly production. The lots receiving skim milk in addition to grain and mash had a higher average production than those receiving granulated buttermilk. The lot receiving 7.5 per cent meat scrap produced the largest number of eggs at the least cost per dozen and had the largest net return over feed cost, while the lot receiving no mash returned the least profit per hen. All rations were satisfactory from the standpoint of maintaining weight.

A comparison of dull-gray ground limestone and a shiny white limestone as sources of shell-forming material, reported in part 2, is a continuation of previous work (E. S. R., 60, p. 261). In the third series the birds receiving

white shiny limestone had an average yearly production of 142.7 eggs per bird, while a similar lot receiving dull-gray limestone had an average production of 141.3 eggs per bird. The shiny white limestone was more attractive, but no more adequate as a source of calcium for good shell formation than the dull-gray limestone. By keeping the latter limestone in an open hopper available at all times, birds could be induced to consume an adequate supply of this supplement.

Concluding the study on all mash v. grain and mash for laying hens (E. S. R. 62, p. 256) in part 3, it was found that there was little difference in the total consumption of feed on an all-mash or a grain and mash ration. No significant difference existed in mortality, health, fertility, and hatchability of the different pens. When a drop occurred in body weight it was usually followed by a decline in production, and sudden changes in temperature had the same effect on production. Barred Plymouth Rocks on a grain and mash ration returned 17 cts. more profit per bird than those on an all-mash ration, while White Leghorns receiving all mash exceeded by 15 cts. per bird the profit of the grain and mash ration. The mortality rate in all pens was low. It was more difficult to maintain sanitary surroundings in the all-mash pens, due to the moist droppings and wet litter.

All-night lights for winter layers. D. C. KENNARD (*Ohio Sta. Bimo. Bul.* 141 (1929), pp. 195-198).—In a demonstration of all-night lights for layers, 3 groups of 40 Leghorn pullets each were started on December 1. The groups averaged 19 per cent egg production when the lights were turned on, 39 per cent 2 weeks later, and 57 per cent after 4 weeks of lighting. These birds laid 49 eggs each to March 1, and the mortality to June 15 was 12.5 per cent. Another lot with a 40 per cent production before being lighted increased to 65 per cent in 2 weeks and to 75 per cent in 4 weeks. The pullets in this lot laid 57 eggs each from December 1 to March 1, with a mortality of 12.5 per cent. In another test 24 January-hatched pullets, averaging 45 per cent production, were moved from the range on July 15. Loss of production and molt followed the moving. From October 1 until they received lights only 2 birds were laying, but 2 weeks after lights were turned on practically all birds were laying, and from this time to April 1 production averaged 63 per cent with a mortality of 16 per cent to June 15.

DAIRY FARMING—DAIRYING

Dairy farming for beginners. J. B. SHEPHERD (*U. S. Dept. Agr., Farmers' Bul.* 1610 (1929), pp. II+14, figs. 7).—This publication presents information of a popular nature relating to the factors which must be observed by beginners in dairy farming. Such factors as adaptability of the farm, necessary capital and equipment, selection of animals, and management are discussed.

[Experiments with dairy cattle at the Illinois Station] (*Illinois Sta. Rpt.* 1929, pp. 120, 121, 125-133, figs. 3).—The results of experiments, some of which are in continuation of those previously noted (E. S. R., 60, p. 262), are reported.

Feeding cows copper did not improve milk.—T. S. Hamilton, H. H. Mitchell, and W. B. Nevins found that there was no effect from feeding copper sulfate, even at the rate of 3.2 gm. daily, upon the copper content of the milk produced by cows.

Skin pigment and milk color not found correlated.—No positive correlation was found between color of skin pigment and color of milk fat in dairy cattle by W. W. Yapp and A. F. Kuhlman. The color of the skin pigment of the heavy-producing cows was greatly depleted when they did not receive enough

green feed. Calves of highly pigmented breeds did not show the same amount of pigmentation as older animals until fed green feed.

Transmitting ability of dairy sires varies widely.—In this study Yapp applied the formula $x=2a-b$ (in which x equals the sire's transmitting ability, a the record of a given daughter, and b the record of the dam of that daughter) to the daughters of Jersey, Holstein, and Guernsey sires. When a sire was able to transmit production to his daughters equal to the average production of cows of his class, he was considered to have 100 per cent transmitting ability. Among the 25 Holstein sires studied, the best bull showed a transmitting ability of 265.6 per cent. while the poorest bull had only 89.4 per cent transmitting ability. Of the Jerseys studied, the best bull showed 185.1 per cent and the poorest bull 76.2 per cent transmitting ability.

Study silage made from sweet corn cannery refuse.—Sweet corn cannery refuse silage was found by Nevens to be rather unpalatable when fed alone, but was eaten readily when used as a supplement to pasture or dry-lot feeding. In cooperation with the division of animal nutrition, it was found that the digestible nutrients in 100 lbs. of this silage were: Dry matter 15.3, crude protein 1.2, nitrogen-free extract 8.6, crude fiber 3.6, and ether extract 1.5 lbs. The corresponding figures for Reid Yellow Dent silage were 17.2, 1.1, 11.8, 3.7, and 0.6.

Treating the exposed surface of silage with a chlorine solution appeared to delay bacterial decomposition for a time, but when examined three months later the treated silage was no better preserved than untreated silage, and there was no difference in the bacterial flora. Covering the surface of silage with a layer of roofing paper and an inert material prevented spoilage. The recovery of good silage three months after covering in the above manner was 85 and 86 per cent of dry matter as compared with 69 per cent for silage not covered.

Brown Swiss show high persistency.—W. L. Gaines and J. H. Brock, using the fat yield for the first full month of advanced registry cows of the Brown Swiss breed, found the average persistency for 365-day records of this breed to be 97. The records show that persistency is not affected by age, but that it is greatly affected by the rate of yield.

[Experiments with dairy cattle at the Pennsylvania Station] (*Pennsylvania Sta. Bul. 243 (1929), pp. 16, 20*).—Two experiments, both of which have been previously noted (*E. S. R.*, 60, p. 365), are briefly reported.

The digestibility of the total ration as affected by grinding hay.—The second year's results in this study by S. I. Bechdel and P. S. Williams showed that the ground hay ration was slightly more digestible in all of its constituents, except crude fiber, than the unground hay ration. It is suggested that this decrease in digestibility of crude fiber is due to a decrease in rumination. The difference in digestibility of the other constituents was very small.

The value of a mineral supplement in the dairy ration.—Continuing this study, Bechdel and J. F. Shigley found that cows receiving bone meal supplement produced appreciably larger calves at birth and had considerably more difficulty in parturition than those receiving no bone meal. There was less tendency to go off feed, especially during the winter months, for the cows receiving no supplement than for those receiving bone meal.

Effect of the nutritional plane on utilization of nutrients by the dairy cow, including the consideration of sundry phases of mineral metabolism (*Vermont Sta. Bul. 302 (1929), pp. 14-16*).—These pages reprint a brief report by Ellenberger and Newlander previously noted (*E. S. R.*, 61, p. 257). Tests with rather heavy-producing cows showed that they are not always in serious negative calcium and phosphorus balance when fed little or no legume hay but

receiving liberal amounts of a well-balanced grain mixture. When minerals were added in the form of steamed bone meal and finely ground limestone, the cows were able to assimilate enough to result in appreciably positive balances of these minerals, but did not show that the mineral supplements added greatly to the ration.

Corn silage feeding investigations.—Relative feeding values of the dry matter of different types of silage corn ensiled at different stages of maturity, G. C. WHITE and R. E. JOHNSON (*Connecticut Storrs Sta. Bul. 159* (1929), pp. 313-323).—The combined results of a fourth and fifth trial in this study (E. S. R., 56, p. 870) with milk yield corrected to 13 per cent solids indicate that the dry matter in late-maturing silage was slightly less efficient than that in medium and early maturing silages, but not appreciably so. On the basis of 100 lbs. of milk produced, 93.32 lbs. of dry matter in early, 90 lbs. in medium, and 94.59 lbs. in late maturing silage were consumed. This difference is not sufficient to condemn late-maturing varieties of corn for silage, and the most economical type of corn for silage will depend upon conditions on the individual farm.

Feeding and management of dairy calves in California, S. W. MEAD (*California Sta. Bul. 478* (1929), pp. 31, figs. 7).—Information of a popular nature concerning methods of feeding and management of dairy heifers from birth to first calving is contained in this publication.

How long should Holstein calves receive milk? C. H. CRAWFORD and W. E. KRAUSS (*Ohio Sta. Bmo. Bul. 141* (1929), pp. 183-187, fig. 1).—Continuing this study (E. S. R., 61, p. 169), 8 Holstein heifer calves were divided into 3 lots of 2, 3, and 3 head, respectively. Milk was fed for 60, 90, and 120 days in the respective lots. One calf in each lot received farm-separated skim milk, another received remixed powdered skim milk, and another dry powdered skim milk. No dry milk was fed in lot 1 since this method of feeding is not ordinarily begun until calves are 60 days old. A maximum allowance of 3 lbs. of grain per head daily was allowed while the calves were receiving milk, and later changed to 4 lbs. per head when the milk was discontinued. Each calf received all the good quality mixed hay it would consume.

At 6 months of age the calves in lot 1 were below normal in both weight and height, while those in lots 2 and 3 were 8.9 and 14 per cent above normal in weight and 1.6 and 2.5 per cent above normal in height. At 1 year of age all of the calves were above normal in weight and height, and at 15 months all were considerably above normal in weight, but the calves in lot 1 were 98.8 per cent of normal in height. The gain in live weight from the twelfth to the fifteenth month was in proportion to the length of the milk-feeding period.

Calves fed milk for 90 and 120 days consumed more hay than those fed milk for only 60 days. From the standpoint of development of the calves 60 days was too short a period to feed milk, and from an economical point of view 120 days was too long. Weaning had less effect on calves that received their milk in the form of dry powdered skim milk.

[Experiments in dairying at the Illinois Station] (*Illinois Sta. Rpt. 1929*, pp. 133-137).—The results of several experiments, most of which have been continued (E. S. R., 60, p. 263), are noted.

Tests establish merit of reduction test for milk.—A comparison of the reduction test and the plate method for determining the quality of milk was made by M. J. Prucha and P. H. Tracy. The dyes of methylene blue and Janus green were used in the reduction test. Observations were made every hour for 10 hours, and the relationship between actual plate counts and the length of time it took the milk to reduce the dyes was estimated. In general the results of the two methods agreed very well, and it was considered that

milk which did not change the color of methylene blue in 8 hours was of high quality. No advantage was found in the use of Janus green instead of methylene blue.

Pasteurized milk as good food as unpasteurized.—To show that pasteurized milk was a safer food than raw milk, J. M. Brannon and Prucha fed lots of rats on both types of milk. The raw milk used had bacterial counts ranging from 50,000 to 500 000 per cubic centimeter. After about 6 weeks on this milk, rats lost their appetites and later the hair coats became rough. Adding yeast and cod-liver oil temporarily checked this condition, but within a short time the rats began to die. An examination of the digestive tract showed it to be greatly distended with gas and to be heavily seeded with *coli-aerogenes* bacteria. The digestive tracts of the rats fed pasteurized milk appeared to be normal.

Pasteurizing studies showed that nearly all of the nonspore-forming bacteria are destroyed at a temperature of 142° F., but that none of the spore-forming bacteria are entirely destroyed at 144°.

Study effect of sterilizers upon dairy equipment.—In a study of the effect of different sterilizing compounds and washing powders on 13 different metals, Prucha found that the highly-polished Allegheny metal was the only one used that was not affected by any of the solutions. With the same metal, highly polished on one side and rough on the other, the results showed that it was affected by sodium hypochlorite and chloramine-T solutions having 500 parts per million of active chlorine. Of the chemical sterilizers, Diversol was the least corrosive, attacking only brass and aluminum in all strengths, and Benedict nickel and enameled steel when in a solution containing 500 parts of active chlorine per million.

Ice cream industry may be important honey outlet.—Analyses of 12 honeys for total solids by Tracy and H. A. Ruehe showed them to vary from 75.37 to 91.36 per cent. The flavor of the honeys varied, depending upon the source of the material collected by the bees, but alfalfa and clover honey appeared to have the most desirable flavor, while some others gave undesirable flavors. In sweetening value honey varied from 70 to 75 per cent of that of sugar. Honey did not blend well with vanilla and therefore should not be used for sweetening vanilla ice cream, but it was quite satisfactory with most fruit ice creams. When honey replaced cane sugar, there was little difference in the body and texture of the resultant ice cream if the total solids were the same. Honey ice cream tended to be smoother but somewhat more crumbly than that sweetened with cane sugar. Ice cream sweetened with honey had a lower freezing point, melted more rapidly at room temperature, froze more slowly, and was harder to whip to the proper overrun than ice cream sweetened with cane sugar.

[Experiments with dairy products at the Pennsylvania Station] (*Pennsylvania Sta. Bul.* 243 (1929), pp. 17–19, fig. 1).—The results of several experiments, in continuation of those previously reported (*E. S. R.*, 60, p. 367), are noted.

Problems in the manufacture of ice cream.—C. D. Dahle found that lactose crystallization in nut ice cream could be retarded by soaking the nuts overnight in a solution made by adding 12 lbs. of sugar to 1 gal. of boiling water. Microphotographs showed that lactose crystals were more numerous and smaller in size in plain walnut than in vanilla or walnut ice cream made with nuts soaked overnight in maple sirup.

Studies of aging ice cream mixes by Dahle, J. I. Keith, and A. D. McCullough showed that 4 hours' aging was as beneficial as 24 hours from the freezing-time standpoint. Mixes frozen 1 hour after cooling whipped slower than those aged 4 or 24 hours. The increase in viscosity due to aging was more noticeable between 1 and 4 hours than between any other periods up to 24 hours. Titra-

ble acidity was higher at 1 hour than at 4 hours, and lowest at 24 hours. The pH concentration increased during aging at 40° F. from 1 to 24 hours. The average maximum overrun of 24 mixes aged 24 hours was 120.5 per cent and of mixes aged 4 hours 112.3 per cent, and the average time required to obtain 100 per cent overrun was 8.7 and 8.6 minutes, respectively.

Mixes pasteurized at 170° F. for 10 minutes reached 100 per cent overrun in 8.2 minutes, those pasteurized at 160° for 20 minutes in 8.7 minutes, and those pasteurized at 150° for 30 minutes in 9 minutes. A lower viscosity and a lessened clumping of fat was noticed in the mixes pasteurized at the higher temperatures by Dahle, Keith, and McCullough.

Dahle found that homogenization decreased the stability of the proteins of an ice cream mix in proportion to the amount of pressure. However, when the mix was run through the second valve of a 2-stage homogenizer, the stability of the proteins increased. The stability of the proteins and the fat clumping tendency of the mixes bore an inverse relation to each other. Sodium citrate, calcium hydrate, and sodium bicarbonate affected the pH of the mix and were probably responsible for a part of the increased stability of the proteins.

The effect of homogenizing process on fat dispersion and casein stability of milk and cream.—Further studies by F. J. Doan show that homogenization increases the fat clumping tendency of skim milk, milk, and cream mixtures when sucrose or lactose is added prior to processing, that the removal of the casein from the plasma greatly increases clumping, and that clumping in a given mixture depends upon the efficiency of the homogenizer. Protein stability was decreased as the fat content of the homogenized mixture increased and with increasing pressure, and decreased with each increase in pH concentration and with larger amounts of soluble calcium. In all mixtures containing fat, homogenization reduced the pH value. The fat clumping tendency increased as the protein stability decreased, although this relationship was not true when instability was caused by added or developed acid. Calcium-ion concentration or amount of soluble calcium present affects both fat clumping and protein stability.

A test for butterfat in condensed and evaporated milk.—To overcome the darkened fat column due to caramelized sugar in butterfat tests, W. D. Swope found that a combination of 2 cc. of ammonium hydroxide, 5 cc. of butyl alcohol, and 25 cc. of a mixture of 3 parts of sulfuric acid and 1 part of water added to 9 gm. of sweetened condensed milk and 9 gm. of water gave good results.

VI, The control of bacteria that grow during pasteurization, M. W. YALE (*New York State Sta. Tech. Bul. 156 (1929), pp. 25*).—Continuing this series of studies (E. S. R., 60, p. 771), it has been found that the presence of thermophilic bacteria in pasteurized milk may be detected by direct microscopic examination, together with incubation of agar plates at high temperatures. This type of bacteria gains entrance to the pasteurizing plant through the raw milk.

Factors which favor the development of these bacteria at the pasteurizing plant are (1) the presence of thermophiles in the raw supply, (2) holding hot milk in equipment for periods longer than 30 minutes, (3) repasteurization, (4) cooking of milk solids on the walls of the heater, (5) presence of dead ends, and (6) development of thermophiles within the holder.

The Grindrod Impact Sterilizer, G. J. and A. M. HUCKER (*New York State Sta. Tech. Bul. 155 (1929), pp. 31, figs. 3*).—This method of sterilizing milk, which consists of superheating milk under pressure with a finely-divided jet of steam, has been studied, using milk cultures of pure strains of organisms

of known heat resistance as well as uninoculated milk which has been allowed to develop a heat-resistant flora.

When held at 230° F. for 1 or 2 minutes all of the nonthermophilic organisms were eliminated from the milk. Holding at 240° for 3 to 5 minutes was necessary to reduce all the thermophilic heat-resistant types of bacteria.

This method destroys the cream line of milk, and its use in the market milk field may be confined to semitropical and tropical conditions where sterility is essential. However, the process may be adapted to the sterilizing of fluid milk to be made into condensed, evaporated, or dried milk. The method gives a slight "boiled" flavor to the milk, and also precipitates albumin at high temperatures. On the other hand, it is a rather rapid process, and removes in certain cases dissolved odors and flavors.

VETERINARY MEDICINE

[Report of work in veterinary medicine at the Florida Station], A. L. SHEALY (*Florida Sta. Rpt. 1928, pp. 79-85*).—Five projects were worked upon during the year, reports of two of which, namely, one on Manson's eye worm of poultry by Sanders (E. S. R., 61, p. 876) and the other on Daubenton's seed poisoning in poultry by Shealy and Thomas (E. S. R., 59, p. 581), have been noted.

Brief reference is made to work with the kidney worm of swine (*Stephanurus dentatus*) now under way. The eggs of this parasite, obtained from the urine by various concentration methods, are found to be in an advanced stage of segmentation and capable of hatching in 48 hours at room temperature, liberating the first stage larvae.

The work with diseases of poultry, reported upon by E. F. Thomas, includes fowl paralysis and coccidiosis. Observations were made of numerous cases of fowl paralysis, and the symptoms are described and post-mortem lesions briefly reported upon. About 80 per cent of autopsied birds showed inflammation of the mucus membrane of the duodenum, and most of the cases so affected showed the presence of coccidia in the contents and scrapings of the intestinal tract. The nerve supply to the limbs was affected in a large percentage of the paralyzed birds. About 20 per cent of the birds showed the presence of intestinal worms. Lesions involving the liver were found in 40 per cent of the diseased birds. It is pointed out that the cause of this affection remains to be determined, and that treatment has not proved successful. Coccidiosis was quite prevalent in the State during the year, two types, duodenal and cecal, being observed. The former type has been found in the duodenum of many adult birds affected with paralysis. The cecal type is found most prevalent in at least 50 per cent of the young chicks and is occasionally detected in the adult birds. Several outbreaks of coccidiosis in young chicks have been traced to hens that had chronic duodenal coccidiosis.

Evidence obtained tends to show that cattle affected with "salt sickness" can overcome the condition by having access to a balanced ration to which bone meal has been added.

[Work with diseases of livestock at the Illinois Station] (*Illinois Sta. Rpt. 1929, pp. 79-82, 92-96, 99, 100, 105-108, 119, 120, 121, 122, figs. 3*).—In further work by R. Graham and H. S. Grindley with moldy sweetclover no specific poisonous substance was detected.

The work, by Graham and F. Thorp, Jr., with infectious abortion (E. S. R., 60, p. 272) has led to the recognition of eight herds as abortion free by the livestock sanitary officials of the State. Seventy-two herd owners in 35 counties,

representing more than 2,771 cattle, are now enrolled in the project on abortion disease control.

The immunization of baby pigs against cholera, by Graham and Thorp, was again (*E. S. R.*, 60, p. 272) successful during the year. Of the 1,789 immunized pigs exposed to cholera at market age an average of 3.52 per cent proved susceptible. So far as could be determined the age of the pigs at time of immunization was not in any definite way related to the length of the immunity. Likewise, the potency of the serum and virus used seemed unrelated to the cholera susceptibility. Only 14, or slightly more than 1 per cent, of the 2,287 pigs treated during the 4-year period of 1925-1928 died following exposure to cholera at market time. Such results indicate that baby pigs may be immunized under favorable conditions with little danger. The detailed results of six years' immunization work with baby pigs are presented in tabular form.

The work of the year by Graham and E. C. McCulloch emphasized the importance of rigid swine sanitation. In observations on ascarid infestation the average number of mature roundworms found in the market hogs raised in different lots during the four consecutive years varied from 3 to 45.6. Resting or cropping the lots made no appreciable difference in the infestation, and lots near contaminated ground, irrespective of treatment, harbored viable roundworm eggs, thus emphasizing the need of rearing pigs at a distance from infested ground. It was found as hard to control intestinal bacterial infection in the lot as it was the roundworm. Infectious enteritis, while more serious in young pigs, may attack hogs of any age and was an additional source of loss under the incomplete sanitary measures which failed to control roundworm infestation. In a study of the possible agencies implicated in the spread of ascarid eggs it was found that nonembryonated eggs from swine may pass through the digestive tract of domestic fowls and remain viable, thus suggesting the possibility of domestic and wild birds as agents in their spread. Embryonated eggs were, however, destroyed by passing through the digestive tract of chickens. The well-marked lesions of enteritis found in pigs which had succumbed in 1928 showed that this infection, either alone or accompanied by roundworm infestation, can be an important factor in unthriftiness and pig mortality. It is pointed out that the control of infectious enteritis is dependent upon sanitation, with special reference to clean ground, and that old sows may be carriers of the infection.

In work with outbreaks of vulvovaginitis in hogs during the year by Graham and Thorp the investigators were able to check the disease by eliminating or reducing the damaged corn in the rations. The disease was not produced experimentally by feeding bacteria or molds isolated from the spoiled feed. The causative agent in the damaged feed remains to be determined.

The details of studies by W. G. Kammlade of the effect of different stomach worm treatments upon the death rate and gains in worm-infested lambs are presented in tabular form. The main object of the work was to study the reaction of the lambs in the feed lot after treatment. The lot treated with copper sulfate showed the smallest death loss and a good gain. The highest death loss was in the lot given tetrachlorethylene, all of the extremely weak lambs in the lot succumbing.

Further success is reported by Graham and Thorp in producing formolized botulinum toxoids that will protect animals for several months against feeds contaminated with the botulism organism. The success of the preceding year in detoxifying the B and C toxins without altering their antigenic value (*E. S. R.*, 60, p. 274) was followed by the successful detoxification of the A type. It was found during the year that different toxoids varied in potency, and that the original potency of some toxoids stored at ice-box temperature gradually de-

creased. The original potency of some toxoids was lost in less than 12 months. Furfural failed to detoxify botulinum toxins without altering their antigenic value. The protective character of one, two, and three doses of combined toxoids A, B, and C against the combined homologous toxins is reported in tabular form. Two or three repeated doses of the three combined toxoids were found to be more consistently protective than a single dose. The range of safety in formolized toxoids seems sufficient to justify the practicability of the detoxified botulinum toxins as an immunizing agent. Three units, or 30,000 formolized lethal doses of toxin, are quite consistently harmless to guinea pigs, while from 200,000 to 300,000 lethal doses, or 20 to 30 units, detoxified by formalin produced no ill effect in horses. The advantage of formolized botulinum toxoid over antitoxin in the production of an active immunity is said to have been apparent, but as a curative agent the toxoid is not superior.

It was found by E. Roberts that the use of Fowler's solution for fitting animals for showing should be discouraged because of the effect upon the spermatozoa. Males that were given Fowler's solution produced, during the feeding of this material, 23.2 per cent of the young, while the same males before feeding produced 46.3 per cent. The mortality among the young from the males not fed Fowler's solution was 7 per cent, while among the young from the treated males the mortality was 28 per cent.

In rigid tests made by Graham and Thorp of an antirabic vaccine, the details of which are presented in tabular form, the commercial single injection rabies vaccine used gave considerable protection against artificial infections of the street virus. The results of immunizing a few hundred dogs is said to have confirmed the findings of other investigators of the value of formolized spleen and brain virus in the prevention of distemper. The spleen vaccine was more efficient than the brain vaccine.

A botanical and chemical study of *Bikukulla eximia*, with a key to North American species of *Bikukulla*. W. W. EGGLESTON, O. F. BLACK, and J. W. KELLY (*Jour. Agr. Research* [U. S.], 39 (1929), No. 7, pp. 477-481, fig. 1).—During the course of a study of the alkaloids of *B. cucullaria* and *B. canadensis*, made in 1921 (E. S. R., 48, p. 674), a new and extremely toxic alkaloid was isolated from the former to which was given the name cucullarine. *B. canadensis* was also found to be poisonous but to a less degree. The results obtained led to a chemical study of *B. eximia*, a species which ranges in the southern Appalachian Mountains from Wills Mountain, Allegany County, Md., south to Georgia. Experimental work conducted and here reported upon has led to the conclusion that the alkaloids contained therein are of slight physiological activity, and that the plant should not be classed as a poisonous one.

A table is given which summarizes the chief chemical and physical characteristics of the alkaloids of the *Bikukulla* group that have been reported, including eximine, the new compound that has been obtained from *B. eximia*. A few notes on the genus *Bikukulla* and a key to its North American species are included.

Studies on infectious mastitis, with special reference to streptococci.—First report. G. D. BRIGHAM, J. G. MCALPINE, and E. O. ANDERSON (*Connecticut Storrs Sta. Bul.* 153 (1929), pp. 285-311).—This is a report of preliminary work conducted in which the number of animals injected with bacterins as curative and prophylactic measures in mastitis is considered too small to warrant the drawing of any general conclusion. It is considered, however, that the following statements are justifiable, namely, that (1) autogenous bacterins even when given in small doses appear to exert a marked curative action in severe cases of mastitis and (2) a prophylactic vaccination at intervals of approximately

three months has apparently been efficacious in at least two of the herds. To be effective, however, the bacterin must be applied to all of the animals in the herd.

An epidemiological study was made of four dairy herds in order to determine the presence of hemolytic streptococci in the individual animals. It was found that a large majority of the cows were eliminating alpha and beta streptococci, and that these types persisted in many animals for the entire period covered. Even after dry periods of 6 and 12 months the organism was present in the milk. A few animals have never revealed evidence of infection with hemolytic streptococci, although a progressive infection appeared to exist in each of the four herds. First calf heifers were generally free from the infection, although some calved with streptococci present in the udder. The beta and alpha types, as a rule, appear separately in an individual cow's milk, although they may interchange or occur simultaneously. Disappearance of the types from milk has been noticed, and in a few cases the organism has failed to return. The transitory appearance of the alpha type in the milk of otherwise negative animals has also been observed. In all probability these were contaminants from the milker's hands and were of no significance.

Report of the work performed by the officer in charge of the camel specialist's office, Sohawa, for the year 1927-28, C. K. SINGH (*Punjab Civ. Vet. Dept., Vet. Bul. 1 (1929), pp. 4*).—This is a report of work conducted in continuation of that of the previous year (*E. S. R., 60, p. 475*). The report is presented under the headings of surra in camels, surra in equines, surra transmission experiments, treatment of mange in camels, and a fly survey of the Punjab.

In 30 surra transmission experiments conducted during the year with *Ornithodoros crossi*, this tick was found to be capable of spreading the disease up to 622 days after it has been fed on an infected animal. It was found that the tick can survive without food for 720 days, or 24 days longer than recorded in the report of the preceding year. Attempts to transmit surra through the milk of the mothers to healthy born bucha gave negative results.

Tuberculosis of the common crow.—A preliminary study, C. A. MITCHELL and R. C. DUTHIE (*Amer. Rev. Tuberc., 19 (1929), No. 2, pp. 184-189*).—The authors report having received 36 common crows (*Corvus brachyrhynchos*) in February, 1928, from western Ontario, Canada, where crows were reported to be dying in large numbers from a disease simulating "ocular roup" of domestic birds. Upon post-mortem examination 5 crows were found to have fairly extensive and well-defined lesions of tuberculosis. In 4 of the 5 the lesions were confined mainly to the liver with a very moderate invasion of the spleen and relatively few acid-fast bacilli present. In an examination of 4 crows captured at Ottawa in the summer of 1928, one revealed a few small tuberculous lesions of the liver containing acid-fast microorganisms similar to those found in the crows from western Ontario. Thus, 15 per cent of the 40 crows examined showed well-defined tuberculous lesions in which acid-fast microorganisms could be demonstrated. The results of inoculation experiments with the organism are reported in detail in tabular form.

A case of tuberculosis in a cowbird, C. B. HUDSON and F. R. BEAUDETTE (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 7, pp. 1064-1066*).—This is a contribution from the New Jersey Experiment Stations in which the authors report upon a case of tuberculosis in the cowbird (*Molothrus ater*).

Reliability of the tuberculin test, J. R. MOHLER (*U. S. Dept. Agr., Misc. Pub. 59 (1929), pp. 4, figs. 2*).—This is a brief practical account. It is pointed out that tuberculin is harmless, that retesting shows the efficiency of the method, and that meat-inspection records reveal less tuberculosis. The best

scientific evidence and observations of millions of carcasses indicate that the tuberculin test is more reliable than the customary post-mortem examination as a means of detecting tuberculosis.

Tularemia in North America and tularemia-like disease in the Union of Socialistic Soviet Republics [trans. title], S. M. NIKANOROV (*Vest. Mikrobiol., Epidemiol. i Parazitol.* (Rev. Microbiol., Épidémiol. et Parasitol.), 7 (1928), No. 3, pp. 289-293; Eng. abs., p. 340; abs. in *Jour. Amer. Med. Assoc.*, 93 (1929), No. 9, pp. 696, 697).—The author records three extensive outbreaks of tularemia, involving more than 1,000 persons, in three Russian provinces. The disease was contracted from a new animal host and transmitter, the water rat (*Arvicola amphibius* L.), the fur of which is highly prized as of commercial value.

Studies with the strongyloid nematode *Haemonchus contortus*.—I, Acquired resistance of hosts under natural reinfection conditions out-of-doors, N. R. STOLL (*Amer. Jour. Hyg.*, 10 (1929), No. 2, pp. 384-418, pl. 1, figs. 5).—In work at the Rockefeller Institute for Medical Research at Princeton, N. J., an experiment was conducted in which two helminth-free lambs upon fenced-in pasturage permitting natural repeated infection developed during the summer, following an initial dose of *H. contortus* larvae, first an accumulation of parasites and then a self cure which expelled the worms and protected the animals thereafter against any significant amount of further infestation with this stomach worm. The rise and fall of the infestations were followed by enumerating the eggs in the feces, and the basis of this procedure is set forth. The parasitic test of this acquired resistance is given, and the bearing of the concept is emphasized in relation to host-parasitic relationships with helminths.

A list of 50 references to the literature is included.

The sheep stomach worm, G. H. LAMSON, JR., and A. F. SCHULZE (*Connecticut Storrs Sta. Bul.* 157 (1929), pp. 259-284, figs. 8).—This is a report of a study of the sheep stomach worm (*Haemonchus contortus* Rud.) and control measures commenced at the station in 1919. A description is first given of the parasite in its several stages.

Tests conducted during the winters of 1919-20 and 1920-21 resulted in the finding of live larvae in samples of manure exposed to the weather, indicating that they are able to overwinter on Connecticut pastures. It was observed that the larvae continued to remain active until the sheep manure was dried out sufficiently to cause it to crumble. Drying is considered one of the most important natural factors in causing the death of the immature worms, otherwise so tenacious of life. From a study of the effect of this parasite on sheep, in which blood examinations were made, it is concluded that badly infested sheep may have only a third or a quarter of the normal number of red blood corpuscles.

Control work was conducted with iodine, copper sulfate, chenopodium, and tobacco and copper sulfate, the details of which are presented in tabular form. Thus far, iodine has been found to be the most effective vermicide tested, with the least danger of injuring sheep. Lugol's solution, a 5 per cent solution of iodine in water, to which is added 10 per cent of potassium iodide, has been used. The drenching method was used and consisted in administering 4 oz. of a solution made by adding 1.5 oz. of Lugol's solution to 1 qt. of water to lambs weighing over 30 lbs., and repeating this drenching once each 4 weeks. It is believed that this kills the larvae in the stomachs of the lambs and tends to prevent the number of worms from becoming numerous, destroying most of them before they become mature. In drenching older sheep, each animal received 4 oz. of a solution made by adding 2 oz. of Lugol's solution to 1 qt. of water, and repeating this at 4-week intervals during June, July, August, Sep-

tember, and November. For sheep found in other flocks, not previously treated with iodine, or those that were not treated consistently through the summer and that showed marked symptoms of stomach worms, the authors used for each sheep from 4 to 6 oz. of a solution made by adding 2 oz. of Lugol's solution to 1 qt. of water.

Sheep that had been treated were killed two hours later, examinations of the contents of the stomach showing that in a great majority all or nearly all of the worms were dead. In a few cases there was some irritation to the lining of the stomach but not enough to be likely to cause injury. Several hundred sheep that were not killed after the treatment lived on in the best of health.

[**Work with diseases of poultry at the Illinois Station**] (*Illinois Sta. Rpt. 1929, pp. 96, 109-112, 116-119, figs. 2*).—In further studies of avian tuberculosis by R. Graham and R. L. Hectorne, it was found that the Yersin or nontubercle type of lesion could not be reproduced in fowls by inoculation. Yersin-infected liver tissue when injected into healthy fowls produced the Villeman or tubercle type of the disease. A histopathological study of a group of Yersin livers showed a distinct tendency for the *Mycobacterium tuberculosis* (avian) to form clumps rather than to become evenly distributed through the tissue.

In examinations made by Graham and F. Thorp, Jr., of 1,728 eggs in 6 different groups obtained from 5 different hatcheries and the station incubators, *Salmonella pullorum* infection was found in varying degrees up to 8.4 per cent and saprophytic bacteria, principally cocci, in from 3.6 to 20.3 per cent of the embryos. It is concluded that hatchability can not be regarded as an accurate index of pullorum infection. Virulency of *S. pullorum* and vitality of the chicks, as well as other factors, are considered to play an important part in the inroads of this disease on the embryo as well as on the newly hatched chick.

It is concluded that brooder pneumonia in baby chicks is in most cases a lung type of pullorum disease. While the value of the treatment of eggs with chemical disinfectants in the control of coccidiosis is as yet undetermined, disinfectants in proper proportions apparently do not interfere with hatchability. Eggs were completely immersed in 1 per cent Lugol's solution, 1 per cent phenol, 5 per cent phenol, sterilac solution used at the rate of 1 teaspoonful to a gallon of water, bichloride of mercury in dilutions of 1 to 5,000 and 1 to 10,000, and 95 per cent alcohol. No ill effect on hatchability was noted with these disinfectants. Dipping eggs in stronger dilutions of bichloride of mercury lowered hatchability. Lugol's solution, phenol, or chlorine preparations, such as sterilac, apparently are preferable to bichloride unless the latter is used in a high dilution.

In one group of fowls reacting to the agglutination test for pullorum disease that was kept in the same pen with nonreacting fowls for several months the disease gradually spread when nonreacting males were added to the pen. It was found that males artificially infected in the reproductive organs very promptly gave a positive blood test. Mature infected fowls in the experiment occasionally developed pericarditis. Two experimental liquid pullorins which gave favorable comparisons with the agglutination test were prepared on Long's synthetic media, or a modification of Long's media, and on standard chicken broth to which beef extract was added. The results obtained with three experimental pullorins, as judged by agglutination tests of the same fowls, are presented in tabular form. Apparently potent liquid pullorins properly administered and interpreted may detect approximately 75 per cent of the agglutination reactors.

Added proof that hereditary factors are involved in bacillary white diarrhea was obtained by Roberts and Card (*E. S. R.*, 60, p. 274).

In a study of fowl bronchitis by Graham, Thorp, and Hectorne, in which certain characteristics of the disease were established, the cause was not determined in the course of outbreaks which have appeared with increasing frequency during the past five years. Investigations have established the facts that (1) the spontaneous disease known as infectious bronchitis may be communicated from infected to healthy fowls by contact or by pen exposure, (2) the disease is highly contagious, and the virus is present in the mouths and respiratory tracts of infected birds, (3) chicken pox may be a complicating factor in some outbreaks, or chicken-pox infection of the respiratory tract may resemble infectious bronchitis, (4) when subacutely or chronically affected fowls that have recovered from the disease and appear healthy are exposed to cold the development of the acute form of the disease characterized by mouth breathing may follow, (5) spontaneously affected squabs may show symptoms of bronchitis comparable to the disease in chickens, (6) an acute septicemic form of bronchitis in fowls may cause death in a few hours, and (7) sanitation and proper management are the most hopeful methods of control, since no medicines, serums, or vaccines thus far studied have been of value in the prevention or cure of the disease.

It has been found by Graham that avian diphtheria, or canker, can be reduced and possibly eliminated in many flocks if cutaneous chicken-pox vaccine is properly used. The vaccine should be applied during August, September, and October before fowls go into winter quarters. It may be used in infected flocks to check the progress of the disease, but is more beneficial if used early in the fall.

[Poultry disease studies at the Pennsylvania Station] (*Pennsylvania Sta. Bul.* 243 (1929), pp. 7, 19, 20).—Reference is made to studies of big liver disease of fowls by A. K. Anderson, in which 48 samples of the blood of chickens were analyzed. Of these chickens 4 had definitely enlarged livers, but their blood was not conspicuously different from that of the normal birds.

Work conducted by R. P. Tittsler on the sterilization of nonfertile incubator eggs for poultry feed has shown that boiling for five minutes will kill all bacteria.

The results of autopsies made of some 400 birds from 150 farms, 175 of which were chicks under one month of age, are briefly referred to by Tittsler. No bacterial infection in big liver disease was found. Outbreaks of septicemic *Salmonella pullorum* infection in adult fowls were observed, most of the cases being in pullets during January and February.

Reference is made by Tittsler to studies of *S. pullorum* conducted in continuation of those previously noted (*E. S. R.*, 60, p. 374). Variations in temperature of incubation, kind and amount of peptone used, H-ion concentration, and salts have produced marked effects. In general, *S. pullorum* produces hydrogen sulfide. Thus far Difco lead acetate agar has given the best results. The effect of H-ion concentration upon the fermentation of maltose by *S. pullorum* is being studied.

Therapy of coccidiosis.—II, Coccidiosis of the chicken [trans. title], B. J. KRUGSMAN (*Tijdschr. Diergeneesk.*, 56 (1929), No. 14, pp. 734-748, fig. 1; *Ger., Eng., Fr. abs.*, pp. 747, 748; also in *Centbl. Bakt.* [etc.], 1 Abt., Orig., 111 (1929), No. 6-8, pp. 426-436, fig. 1).—In experimental treatment of this affection of the fowl (*E. S. R.*, 58, p. 679) cresol, formaldehyde, catechu, semen arecae, Naganol, all given by the mouth. Naganol administered subcutaneously, and yatren given intramuscularly, were ineffective. Lactose had no specific action upon coccidiosis, but gave good results in cases of slight infection, which is considered to be due to its nutritional value. Treatment of cecum-coccidiosis through the rectum is considered of no avail.

Creolin therapy in rabbit coccidiosis [trans. title], B. J. KRIJGSMAN (*Tijdschr. Diergeneesk.*, 56 (1929), No. 18, pp. 990-993, fig. 1; *Ger., Eng., Fr. abs.*, pp. 992, 993).—The author calls attention to the fact that creolin possesses curative properties in rabbit coccidiosis (E. S. R., 58, p. 679). Since the administration of creolin by means of the stomach tube presents difficulties, the following formula is prescribed: Creolin 25 cc., sodium bicarbonate 4 gm., sirup 400 cc., water 2,000 cc. and oil of anise 4 drops. Each affected animal (about 8 weeks of age) is given 25 cc. of this mixture daily for 3 days. It is said that rabbits drink this preparation readily when kept on very dry food-stuffs and no other drinking water is supplied.

The life history of *Tetrameres americana* (Cram, 1927) Baylis, 1929, a spirurid of the proventriculus of chickens, E. B. CRAM (*Jour. Parasitol.*, 15 (1929), No. 4, p. 293).—The complete life cycle of this nematode has been demonstrated experimentally with the differential grasshopper as the intermediate host.

The occurrence of *Dirofilaria scapiceps* in rabbits, J. E. ALICATA (*Jour. Parasitol.*, 15 (1929), No. 4, p. 287).—The infestation in North Carolina of the tarsus of a rabbit, thought to be *Sylvilagus palustris*, by this parasite is recorded. Four previous records of parasitism of rabbits by this species are referred to.

AGRICULTURAL ENGINEERING

[Agricultural engineering studies at the Illinois Station] (*Illinois Sta. Rpt.* 1929, pp. 108, 189-208, figs. 5).—Tests by C. W. Crawford and E. T. Robbins of the pulling power of 144 different teams indicated that weight is one of the first essentials in a team used for pulling big loads. Horses making good records also were energetic but not flighty in disposition, were well trained, carefully hitched, and well shod. The results showed also that in a group of horses of equal weight, those with the greater heart girth exerted the greater tractive force. Horses also must be in good flesh to do their best. A good disposition is a valuable asset, and a skillful driver is as necessary as good horses. Barefooted horses were unable to hold their own with well-shod teams.

The results of a study by E. W. Lehmann of sludge accumulation in three isolated septic tanks are presented and discussed. These indicate that there is an unloading of sludge under certain conditions. This apparently occurs in tanks that are functioning properly with a normal discharge through the tank.

The results of tests by R. I. Shawl of eight oils for tractor lubrication indicated an apparently close relation between the ability of an oil to resist crank-case dilution and the number of hours it can be used in an engine.

Tests of corn borer control machinery and practices, by Shawl, A. L. Young, and R. B. Gray of the U. S. D. A. Bureau of Public Roads, indicated that plows equipped with properly adjusted jointers, covering wires, and full-size, or better, extra-large coulters, will cover cornstalks far better than when equipped only with small worn coulters. Other conditions being the same, large-bottomed plows will cover slightly better than the smaller bottoms. In general, some treatment of the stalks previous to plowing such as disking, rolling, breaking with a pole or harrow, or raking and burning, will permit a plow to do better covering. Soil conditions, particularly the amount of moisture, influence the extent to which trash can be covered, as well as the quality of plowing. Joint-

ers of the right type aid tremendously in getting good covering, particularly when used in conjunction with covering wires. Proper hitching, proper adjustment of coulters and jointers, and correct placing of wires are essential. Fields in which livestock had been pastured showed a higher average count than those not pastured, although some exceptionally clean fields were ones that had been heavily pastured when muddy. There appeared to be no difference between fields plowed with tractors and those plowed with horses. Plows equipped with weed rods or covering wires did no better work than those not so equipped, indicating that these are of little value unless carefully placed and adjusted.

The combine tests by Young indicate that the amount of grain lost should not be the deciding factor in determining whether or not combining should be substituted for the binder-thresher method of harvesting small grain, not including soybeans. The quality of grain obtained and the cost of harvesting are probably more important. In combining, those conditions or methods of operation that turn out grain of good quality will also tend to decrease losses.

The studies by Lehmann, Young, W. L. Burlison, and G. H. Dungan of artificial drying of crops indicated that when drying wheat by blowing heated air through layers of varying thickness under given conditions there is probably one thickness of layer that is most favorable. An attempt to dry a fairly large batch of ear corn revealed the difficulty of securing uniform and complete drying. The drying of small samples of ear corn, shelled corn, wheat, and oats in air having a constant velocity, temperature, and humidity showed that the moisture content of small grain and shelled corn can be reduced much faster than that of ear corn, and that the rate of drying is more rapid when the moisture content is high. Tests made on the shrinkage of cribbed corn revealed that ear corn reached its driest condition in July, as an average of three two-year tests. The factor that had most to do with the degree of shrinkage was the percentage of moisture in the corn at the time of cribbing. Rainy weather and high atmospheric humidity retarded shrinkage in newly stored corn and increased the rate of water absorption in corn during its second year of storage. The wide fluctuation in shrinkage from month to month indicates that corn absorbs moisture rather readily.

Data are also included and discussed on corn production with mechanical power and the draft requirements of corn borer plows.

[Agricultural engineering investigations at the Pennsylvania Station], H. B. JOSEPHSON and R. U. BLASINGAME (*Pennsylvania Sta. Bul. 243 (1929), pp. 21, 22, figs. 2*).—The progress of studies of power and labor, of electrical refrigeration requirements for Pennsylvania dairy farms, and of small portable electric motor requirements for Pennsylvania agriculture is briefly recorded. The details of the last-named studies have been noted previously (*E. S. R.*, 61, p. 880).

Electrical statistics for California farms, B. D. MOSES (*California Sta. Circ. 316 (1929), pp. 20, figs. 7*).—This bulletin is a contribution from the station and the California Committee on the Relation of Electricity to Agriculture. It presents statistics on the uses of electricity in California agriculture. The data show that the California farmer already uses electricity extensively and that the trend is upward. They also show that the heaviest farm load occurs in the summer time, that the peak appears in July or August, and the valley in January, and that over 50 per cent of the energy used for power purposes is consumed during the months of June, July, August, and September.

Farm machinery and equipment, H. P. SMITH (*New York and London: McGraw-Hill Book Co., 1929, pp. XII+448, figs. 554*).—This book represents the fruits of several years' study and experimentation by the author with various

types of farm machinery and mechanical equipment at the Agricultural and Mechanical College of Texas and the Texas Experiment Station. It covers the most important types of machines used in present-day general farming, and opens with a comprehensive discussion of the more important phases of physics and engineering mechanics involved in the analysis of the design, operation, and adjustment of these machines.

The main part of the book is devoted to the design, construction, operation, and efficiency of the various types of farm machines. Special attention is given to plows and other tillage implements because of their universal importance in seed-bed preparation.

Machinery used in the growing, harvesting, and preparation of cotton for the market is given special attention also, and the combine is thoroughly covered. Other chapters are included on seeding, harvesting, seed-separation and fertilizing machinery, transportation equipment, and cleaning and grading machinery.

The book marks a departure in the treatment of the subject in that it summarizes progress in research and development of technical knowledge relating to important machines and mechanical processes, thus making it useful not only as a text but as an engineering handbook.

[**Energy requirements, capacities, and characteristics of the cutters and grinders used for processing feeds**] (*Kansas Sta., Fort Hays Substa. [Pamphlet], 1929, pp. [8-12], figs. 2*).—The results of a series of test runs on several different silage cutters and hammer mills in connection with feeding experiments noted on page 362 are reported.

The most important single factor affecting the energy requirements of the silage cutters was the speed at which the elevating fan was operated. If the speed was excessive, energy was wasted in overcoming air friction. An increase in speed gave a relative increase in capacity, but experiments indicated that when the speed was doubled the power consumption increased approximately seven times due to the increased air friction. From 400 to 550 r. p. m., when maintained, was sufficient speed to operate any of the cutters while elevating into a 40-ft. silo. Sharpness of knives was next in importance in the operation of the silage cutters. The energy for cutting kafir silage into 0.25-in. lengths increased approximately 1 per cent for every ton load that passed through the cutter. The increase in power consumption was 35 to 60 per cent for dull knives over sharp ones, depending upon the material cut. There was a greater tendency for the knives to dull when the cutter was operated at the higher speeds, due to the greater impact with which the knives hit the bundles.

The capacities of the cutters varied from 5 to 15 tons per hour, using a 10 h. p. motor. The amount cut depended upon the condition of the material and the length cut. The capacity increased about 35 per cent for a 0.5-in. cut over a 0.25-in. cut. Two men were required to operate the hammer grinders, one to cut bands, divide bundles, and place them within reach of the feeder, while the other did the feeding. On the other hand, only one man's time was required for feeding the combination grinder because of the excellent feed table with which this mill was equipped. It was impossible to maintain uniform feeding into those mills which were not equipped with some type of feeding mechanism. Consequently, due to this unevenness of feeding, the average capacities secured were not the maximum capacity of the mill.

The cost of grinding was about 70 per cent greater for the hammer type mills than for the combination knife and burr mill.

The operation and care of the combined harvester-thresher, W. M. HURST (*U. S. Dept. Agr., Farmers' Bul. 1608 (1929), pp. II+14, figs. 9*).—This is based on information secured in cooperation with the Texas, Oklahoma, Kansas,

Nebraska, Montana, North Dakota, South Dakota, Minnesota, Indiana, Illinois, Pennsylvania, and Virginia Experiment Stations. It contains practical information relating to the care and operation of the combine, and deals especially with combine attachments.

A study of loss of rice in binding, E. J. STERNIMAN and C. F. DUNSHEE (*Agr. Engin.*, 10 (1929), No. 10, pp. 335, 326, figs. 3).—Studies of field losses caused by harvesting Calora rice with a self-binder, which were conducted for two years at the California Experiment Station, are reported.

The total loss in binding in 1927 was 73.6 lbs. per acre, and in 1928, 72.1 lbs., or an average of 0.22 per cent of the total yield. The conditions under which these tests were conducted would probably show the minimum loss for binding. The grain was not overripe, having a moisture content of from 20.2 to 22.4 per cent when bound and decreasing to 13.6 and 14.1 per cent when threshed 10 days later. An overripe field in which harvesting was delayed by rain showed a loss in excess of 50 per cent. This loss was due not only to the shattering of overripe grain when bound, but to excessive lodging and wind shatter. In both cases, by far the greatest loss was at the binder head, being 53.7 per cent in 1928 and 66 per cent in 1927. In 1927 over 19 per cent of the loss was in the bundle wagon and in shocking.

Poultry houses and equipment, J. E. DOUGHEETY and H. L. BELTON (*California Sta. Bul.* 476 (1929), pp. 100, figs. 107).—Practical information is given on the planning and construction of poultry houses and equipment for California conditions, together with numerous working drawings and bills of materials.

Sectional wall nests, D. C. KENNARD (*Ohio Sta. Bimo. Bul.* 141 (1929), pp. 198–201, figs. 2).—A drawing and bill of materials for sectional wall nests are presented and briefly discussed.

A study of dairy coolers in California, J. R. TAVERNETTI (*Agr. Engin.*, 10 (1929), No. 10, pp. 314–316, figs. 5).—In a contribution from the California Experiment Station and the California Committee on the Relation of Electricity to Agriculture, the results are reported of a study which comprised a survey of 73 operating dairies, the determination of the power consumption of various plants over a period of one year, and the determination of the operating characteristics of representative plants.

The conclusion is that the big problem in dairy refrigeration is the selection of the proper size of plant. In order for this to be possible it seems necessary that the refrigeration machine manufacturers rate their machines upon a standard basis and in terms understandable to the average dairyman.

It appears that the running time per day of the compressor depends on its size, on the gallons of milk cooled, on the number of degrees the milk is cooled by machine, on the difference in internal and external temperatures of the storage box, and on the size and insulation of the storage box.

From 25 to 54 per cent of the plant load is produced by the heat removed from the milk. The larger the percentage of the load produced in this way the greater will be the number of gallons cooled per degree per hour of operation per unit rated capacity of the compressor. A comparison of the performance of these machines upon a rated capacity basis does not agree with a comparison upon a power consumption basis.

Suggestions on the construction and operation of dairy farm cooling plants, B. D. MOSES (*Agr. Engin.*, 10 (1929), No. 10, pp. 327–329, figs. 3).—Practical information on the subject is given in a contribution from the California Experiment Station.

Studies of the septic tank method of sewage disposal for isolated homes, H. B. WALKER and R. H. DRIFTMIEER (*Agr. Engin.*, 10 (1929), Nos. 8, pp. 256–258,

figs. 5; 9, pp. 300-302, figs. 8; 10, pp. 330-332, fig. 1).—The results of studies conducted at the Kansas Experiment Station are reported.

The two-chamber septic tank for the treatment of sewage from farm homes is deemed effective in preventing a nuisance when properly designed. The volume of sewage flow varies from 9 to 35 gal. per person per day, with 20 gal. indicated as a reasonable allowance in considering volumes of sewage for farm home septic tank design.

Sewage flow from the farm home is greatest during the summer months and least during periods of lowest temperature. Monday and Saturday are the peak days.

Scum formations tend to increase in thickness with prolonged rises in temperature and tend to decrease with corresponding decreases in temperature. The trend of the temperature of the tank liquors follows atmospheric temperature trends, but these are relatively higher in winter and lower in summer than the atmospheric temperatures. The maximum and minimum temperatures of the tank liquors during these studies were 73° F. maximum and 48° minimum. The mean liquor temperature was 58.9°.

Of the total solids entering the siphon chamber 88.5 per cent were dissolved and 11.5 per cent remained as suspended solids. A retention period of less than 60 hours for the sewage in the septic chamber tends to increase the percentage of suspended solids in the effluent. A retention period of 60 to 72 hours would seem to represent good design for farm installations.

The bacterial analyses indicated an average decrease of 18.9 per cent in the total bacteria count and an average decrease of 32.6 per cent in the total colon count. Subirrigation systems receiving sewage in doses from siphons must have the tile joints protected with tar paper or some other equally effective means to prevent infiltration of soil through the joint openings.

A bibliography is included.

RURAL ECONOMICS AND SOCIOLOGY

[Investigations in farm organization and management and agricultural economics at the Illinois Station, 1928-29] (*Illinois Sta. Rpt. 1929, pp. 152-188, figs. 8*).—The results of investigations not previously noted (*E. S. R., 60, p. 281*) are reported as follows:

[*Farm organization and management*, H. C. M. Case, M. L. Mosher, J. B. Andrews, and W. A. Herrington] (pp. 152-155).—A table is included summarizing the 1928 records from 150 farms in the cooperative farm bureau-farm management service project and showing similar data for 1925, 1926, and 1927. Another table shows data regarding capital investments, receipts and net increases, expenses and net decreases, net income, rate earned on investment, and labor and management wage on the 30 most profitable and the 30 least profitable farms in 1928 as compared with the average of the 150 farms.

[*Farm earnings*, R. R. Hudelson, P. E. Johnston, H. C. M. Case, and F. L. Underwood] (pp. 155-165).—A table is included summarizing, by areas, the financial organization and returns as shown by business records from 1,258 farms in 33 areas of the State.

[*Cost and profitableness of crops*, H. C. M. Case, R. H. Wilcox, and J. B. Andrews] (pp. 165-167, 168, 169).—Tables are given showing, by years 1920-1927, the variation in cost per bushel of corn, wheat, and oats on high-cost and low-cost farms in Champaign and Piatt Counties, and the average acres of crops per farm, yield, man, horse, and tractor labor, growing and harvesting costs, taxes, interest, income from grain, roughage, and pasture, profit or loss per

acre, and net cost per bushel of producing winter wheat in 1926 and 1927 and corn and oats in 1926, 1927, and 1928 in Clinton County.

[*Cost of producing soybeans*, R. C. Ross and F. L. Underwood] (pp. 167, 170-172).—A table is included showing for soybeans produced for grain, by years, 1921-1927, and the averages for the period, the costs by items, taxes, interest, income, net profit, and efficiency factors.

[*Pork production costs*, R. H. Wilcox and H. P. Rusk] (pp. 173, 174).—Further analysis of data obtained in cooperation with the U. S. Department of Agriculture shows the following facts, respectively, for early and late spring pig production: Size of litters 8.8 and 6.9, number of pigs weaned per litter 5.8 and 5.1, and net cost per 100 lbs. of pork produced \$7.72 and \$8.19.

[*Cost of producing milk*, H. C. M. Case, G. B. Byers, and C. S. Rhode] (pp. 174, 175).—A table is given showing for 1928 for 100 Lake County dairy farms and for the 33 most profitable and the 33 least profitable farms the average investment per farm by items, income by items, net receipts, and farm business analysis factors. The rate earned for capital and management and the labor and management wage for the three groups were 1.56 per cent and —\$306, 5.62 per cent and \$916, and —3.83 per cent and —\$1,301, respectively.

[*Financial operations of elevators*, C. L. Stewart, L. J. Norton, and L. F. Rickey] (pp. 177-181).—Analysis of audit reports of 171 companies for their business years ended between June 30, 1927, and June 30, 1928, shows that the average surplus per \$100 of stock was \$17.39, that 32.4 per cent of the companies had a net worth of from 50 to over 200 per cent above the par value of the outstanding stock, and that 34.6 per cent had a net worth less than the stock outstanding. In the companies for which 90 per cent or over of the sales consisted of grain, the average expense per \$1 of sales decreased from 6.1 cts. for those having from \$75,000 to \$100,000 worth of sales in 1927 to 3.6 cts. for those having sales of from \$200,000 to \$225,000 and to 3.1 cts. for those having sales of from \$275,000 to \$425,000. The average net expense per bushel of handling corn was 1.55 cts. for companies the grain sales of which amounted to less than 80 per cent of the total sales, 2.55 cts. for those where the grain sales were from 80 to 85 per cent, and 2.76 cts. for those where the grain sales were from 95 to 100 per cent. Companies with from 10 to 30 per cent of their sales made up of merchandise had the best earnings in 1927-28.

[*Price studies*, L. J. Norton] (pp. 182-185, 186-188).—Graphs are included showing the prices of 18 farm products in 1928 and the average for 1921-1928 as compared with the 1910-1914 average; variations in the farm price of corn, January, 1925, to April, 1929, inclusive, between different sections of the State; and for 1921-1928 the monthly average price and frequency of month-to-month increases or decreases in the price of hogs, beef steers, and feeder steers at Chicago.

[*Rural economics investigations at the Ohio Station*] (*Ohio Sta. Bimo. Bul.* 141 (1929), pp. 201-203, 204-207).—Results are reported as follows:

[*Packing of Ohio apples in boxes*, C. W. Hauck (pp. 201-203).—A carload of Rome Beauty apples of U. S. No. 1 grade packed in boxes in 1928 brought an average of \$2.466 per box, as compared with an average of \$1.725 per basket for approximately the same weight and the same grade of apples. The costs of packing were 75.5 cts. per box and 73.5 cts. per basket.

[*Feed cost and returns for veal calves*, J. F. Dowler (p. 204).—The returns above feed cost on 122 veal calves sold from 23 Putnam County farms in 1926-1928 averaged \$11.88 per head. A table is given showing for the calves divided into three weight groups the length of time fed, amount and cost of feed, weight and value, and returns above feed cost.

Occupational history of 1,063 Ohio farm households, P. G. Beck (p. 205).—This study of 1,063 farmers showed that the percentages of farmers who had always farmed and were farming without supplementary occupation in the three sections of the State studied and for the whole number were, respectively, for the best farming section of the western part of the State 84 and 90, the highly urbanized industrial section of the northeastern part of the State 57 and 73, the hill-farming region of the southeastern part of the State 82 and 92, and all farms studied 73 and 84.

Crop production and total value [of crops], J. I. Falconer (p. 206).—A comparison of the average production and total value of crops, 1922-1928, showed that the total value of the corn crop was influenced but little by total production, that the three years of highest total value of wheat were years of nearly normal crops, that for oats the tendency has been for total value to be highest in years of large crops, and that for potatoes there has been a marked tendency for small crops to bring the greatest total return.

Index numbers of production, prices, and income, J. I. Falconer (p. 207).—The table previously noted (E. S. R., 61, p. 883) is brought down through August, 1929.

Wheat outlook charts, with explanations (U. S. Dept. Agr., Bur. Agr. Econ., 1929, pp. [57], figs. 28).—Twenty-eight charts, with explanations, are included showing, by States of the United States, the total wheat acreage and the estimated acreage of different kinds of wheat in 1924, the increase or decrease in total acreage, 1919-1924, and the surplus and deficiency in relation to local requirements; the production of leading countries, 1891-1929; production—world and United States—and United States adjusted farm price, 1895-1929; world supplies and price, 1923-1928; wheat inspections on arrival at inspection points in the United States, 1924; farm prices of wheat and index of retail prices of commodities farmers buy, 1910-1929; relative farm prices of wheat, corn, and oats, January, 1910, to August, 1929, inclusive; yearly prices, 1921-1928, and weighted weekly average prices, June, 1923, to August, 1929, inclusive, of No. 1 dark northern spring and No. 2 amber durum wheat at Minneapolis, No. 2 hard winter wheat at Kansas City, and No. 2 red winter wheat at St. Louis; for 1921-1929 the production, exports, and prices of hard red spring wheat and durum wheat at Minneapolis, soft red winter wheat at St. Louis, and hard red winter wheat at Kansas City; average price at Minneapolis, Kansas City, and Winnipeg, and imports into the United States for milling in bond and for consumption, July, 1921, to August, 1929, inclusive; international trade in wheat, exports and imports, 1920; freight rates from principal producing areas of the United States and Canada to the seaboard for export; and comparative freight charges from producing areas of the world to Liverpool, 1925.

[The cost of producing and marketing strawberries in the Eastern Shore area of Maryland], W. E. WHITEHOUSE, W. J. HART, and W. P. WALKER (*Maryland Sta. Bul.* 315 (1929), pp. 185-214, figs. 4).—Data regarding the cost of producing strawberries were obtained for the years 1927 and 1928 from 91 growers in the Marion, Pittsville, and Federalsburg areas of the Eastern Shore section of the State. Tables and charts are given and discussed showing for each area the acreage in different crops in 1928; the bearing acreage, 1928, of important varieties of strawberries; the labor and power requirements and costs, by items, for developing and operating an acre of strawberries up to harvest for the first and second seasons; and the cost, by items, of producing strawberries f. o. b. local station the first and second years.

The average yield per acre and the cost f. o. b. local station in the Marion area in 1927 were found to be 2,880 qt. and \$252.09 and in 1928 1,440 qt. and

\$116.10; in the Pittsville area in 1927 2,560 qt. and \$234.06 and in 1928 1,280 qt. and \$103.77; and in the Federalsburg area in 1927 3,840 qt. and \$292.46 and in 1928 1,920 qt. and \$186.53. The selling expenses in 1928 amounted to 8 cts. per 32-qt. crate for the Marion area, 10 cts. for the Pittsville area, and 19 cts. for the Federalsburg area, bringing the total average cost per crate for the three areas for the two years up to \$2.76.

The methods of marketing, distribution of Maryland strawberries, competition with other States, and the variations in the prices of Maryland strawberries due to variety, quality, time of selling, etc., are discussed. The average yield per acre, the price received per quart, and the gross value per acre, 1921-1927, were 2.213 qt., 13.9 cts., and \$306.51, respectively, for Maryland, as compared with 1.758 qt., 14.3 cts., and \$250.51 for the five leading competing States. The percentage of Maryland strawberries shipped in carload lots decreased from 71 in 1922 to 30 in 1926 and then increased to 45 in 1928. The trend of prices in Maryland, corrected for the changing value of the dollar, has been downward since 1919, with the lowest prices in 1920, 1924, and 1928.

[Distribution of Florida citrus fruit shipments, 1923-24 to 1926-27], M. A. BROOKER (*Florida Sta. Rpt. 1928*, pp. 87-89).—For the period the percentages of the shipments of oranges and grapefruit, respectively, to different sections of the United States and Canada were for New England 11.3 and 9.1, eastern 41.6 and 34.8, midwest 14.6 and 26.2, southeastern 25.3 and 13.7, western 3.6 and 14.6, and Canada 0.6 and 1.6.

Crops and markets, [November, 1929] (*U. S. Dept. Agr., Crops and Markets*, 6 (1929), No. 11, pp. 417-456, figs. 3).—The usual tables, graphs, summaries, reports, and notes are included (*E. S. R.*, 62, p. 286).

Foreign trade of the United States, annual, 1855-1929: Poultry and eggs, C. G. GRIES (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 41* (1929), pp. [1]+25).—This is a mimeographed set of tables showing the annual exports, imports, reexports and net balance, quantity, and value, 1855-1929, of poultry and eggs. Tables are included as follows: Poultry, live, 1790-1929; poultry, dead or prepared, 1855-1929; poultry and game, fresh, shipments from the United States to Alaska, Hawaii, and Porto Rico, 1903-1929; eggs in the shell, 1855-1929; eggs and egg yolks, dried, frozen, or otherwise prepared, 1877-1929; whole eggs, dried and frozen, and yolks, dried and frozen, 1924-1929; albumin, dried, 1902-1929; albumin, frozen, 1914-1929; total value of eggs and egg products, 1855-1929; and shipments of eggs from the United States to Alaska, Hawaii, and Porto Rico, 1903-1929.

Foreign trade of the United States, annual, 1790-1929: Dairy cattle and dairy products, C. G. GRIES (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 42* (1929), pp. [1]+42, pls. 2).—This is a mimeographed set of tables showing the annual exports, imports, reexports and net balance, quantity, and value of dairy cattle and dairy products. Tables are included as follows: Imports of dairy cattle, 1928 and 1929; butter and cheese 1790-1929; condensed milk, 1871-1929; evaporated milk and powdered milk, 1920-1929; cream powder, 1924-1929; infants' food, malted milk, etc., 1918-1929; fresh milk, 1869-1929; fresh cream, 1910-1929; total dairy products, 1790-1929; and casein and lactarene, 1904-1929. Other tables included show the shipments of dairy products from the United States to Alaska, Hawaii, and Porto Rico, 1903-1929.

United States agricultural trade with the Philippines (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 38* (1929), pp. 8, p's. 5).—This mimeographed report includes tables and charts showing, by years from 1918, 1919, or 1923 to 1927, inclusive, together with totals for prior periods, the exports, total and to the United States, of agricultural products from the Philippines and the

principal commodities exported from the United States to, and imported into the United States from, the Philippines.

Imports of principal agricultural products, by countries, 1925-1928 (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 39 (1929), pp. [1]+18*).—This mimeographed report contains the statistics for imports into the United States, by countries of source, for the years 1925-1928. Similar statistics were published in the Yearbook of Agriculture prior to that for 1928 (*E. S. R.*, 59, p. 486).

The competitive position of the dairy industry of Canada, P. F. BROOKENS (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 40 (1929), pp. [1]+23*).—This mimeographed report discusses the agricultural resources of Canada, agricultural development in relation to industry, the sectional characteristics of Canadian dairying, the alternative farm enterprises as affecting dairying, and the competition of the Canadian surplus of dairy products with similar products of the United States.

Income and expenditures of Minnesota farm and city families, 1927-28, C. C. ZIMMERMAN (*Minnesota Sta. Bul. 255 (1929), pp. 50, figs. 4*).—This bulletin, which is one of the series previously noted (*E. S. R.*, 61, p. 787), reports the results of a study made to find the relative income of farm families and different types of city families and the different methods of spending incomes, amounts used for different purposes, and the influence of size of income, social status, and residence in country or city on the amount and the distribution of expenditures. The information was secured by personal visits during the summer of 1928 to 252 families in two cities with populations of 15,000 and 50,000, respectively, and to 226 farm families in the trade areas of the two cities.

Tables and charts are given for the farm families showing by cash-receipts groups the following averages: Adult units per household, cash receipts per family and per adult unit, and total expenditures; expenditures by types (amounts and percentages of total); net cash spent other than for farm costs of production and amounts and percentages spent for investment, automobiles, and living; and distribution (amounts and percentages) of investments, of living expenses, of household and operation expenses, and of miscellaneous living expenditures.

The analysis for the farm families showed the average cash receipts and net spendable income after paying costs of production to be \$3,647 and about \$2,124, respectively. The cash receipts and net spendable income for the modal group ranged between \$1,500 and \$2,500 and between \$1,400 and \$2,000, respectively. The study of the farm families showed that land ownership with its rights and privileges (and responsibilities) is one of the major values in improved living, and that the second is a greater consumption of urban manufactured goods and professional services. It also indicated "that the trend to evaluate farm life entirely or largely by the consumption of urban manufactured goods and professional services omits some of the finer and most important values of farm life," and that farm families in common with village and town families and the investment banking public generally need improved facilities for the investment of funds not going into the farm itself or into acquiring title and rights to land.

For the city families, tables and a chart are given showing by the social class of the head of the household the average number of adult units, income, and expenditures per family, and by income groups the following averages; Adult units, income, expenses, percentage distribution of sources of income, and the distribution (amounts and percentages) of expenditures, of investments, of household expenditures for all families, renters, and owners, and of miscellaneous expenses.

The average incomes and expenditures of the urban families were between \$3,800 and \$4,000. The range for the modal group was from \$1,500 to \$2,500. The analysis of the distribution of expenditures indicates that, contrary to opinions expressed in many budgetary studies, urban families, especially the upper class, placed the acquisition of property, security, and high proportions of unearned income as one of the first values of improved living. The study also showed that the distribution of the total budget is a more satisfactory index of the standard of living than are miscellaneous expenditures.

A comparison of rural and urban incomes and expenditures showed that "farmers are really better off as to both incomes and standards of living than the lower two-thirds of the urban population." A comparison of the property accumulated by the rural and urban groups suggests that the lower four-fifths of the farm families are in as good condition as the lower four-fifths of the urban groups, if not in better condition than these families. The accumulation in the case of the farm group is much more rapid in the earlier years, but not so rapid in the latter ages.

Comparisons of the housing and housing equipment of the two groups showed that as to rooms per family the rural families surpassed, the average number of rooms per family for all cash receipts or income groups being 6.8 and 6.5, respectively, for the rural and urban groups, but as to heating and lighting the urban families surpassed.

Suggestions are made and discussed as to how farm living conditions may be improved.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Agricultural education in the United States, W. H. SHEPARDSON (*New York: Macmillan Co., 1929, pp. IX+132, figs. 3*).—This book is discussed editorially on page 301.

List of technical workers in the Department of Agriculture, and outline of Department functions, 1929 (*U. S. Dept. Agr., Misc. Pub. 63 (1929), pp. X+117*).—The technical workers of the Department are listed by bureau divisions, and a brief outline is included of the principal functions of the different branches of the Department (*E. S. R., 60, p. 387*).

FOODS—HUMAN NUTRITION

[**Food studies in Illinois**] (*Illinois Sta. Rpt. 1929, pp. 247-249*).—Two more varieties of Illinois wheat (*E. S. R., 60, p. 288*), Michigan Amber and Fultz, have been found to have good baking qualities. Excellent bread has been made from all middlings flour, both bleached and unbleached, from each of the four varieties which have now been studied. Second grade flours have proved unsatisfactory for bread making, but satisfactory for muffins and cake.

The investigation of the distribution of vitamin B in cereal grains (*E. S. R., 60, p. 294*) has been extended by R. A. Hetler, C. R. Meyer, and M. Plant to a study of the relative distribution of vitamins F and G. It has been demonstrated that the whole grain cereals oats, wheat, corn, and rice are richer in vitamin F than in G. With corn and oats as the sole source of the vitamin B complex, growth was optimum only when the cereal was supplemented by some other source of vitamin B. Lettuce, egg yolk, milk, and autoclaved yeast have been found to furnish sufficient vitamin G to supplement the whole cereals. Two common oat products have been found to retain almost all of their original vitamin F potency.

A continuation by Hetler and Meyer of the studies of the vitamin A content of yellow corn (E. S. R., 60, p. 291) has demonstrated that from 10 to 15 per cent of whole yellow corn or 5 per cent of corn gluten furnishes enough vitamin A for normal growth and excellent nutritive condition in laboratory rats. It is concluded that yellow corn or corn gluten and yellow corn meal are among the cheapest sources of vitamin A.

Further evidence has been obtained by Hetler and Meyer that the concentration of vitamin A in the oat kernel is negligible. Oat oil was found to contain some A, but too small an amount to make oats of any value as a source of this vitamin.

Nutritive value of proteins in certain kinds of sausage and other meat food products, R. HOAGLAND and G. G. SNIDER (*Jour. Agr. Research* [U. S.], 39 (1929), No. 7, pp. 531-537).—Following the methods used in previous studies (E. S. R., 57, p. 389), the authors have compared the nutritive values of the proteins in certain kinds of sausages and other meat food products with those of beef chuck and fresh pork ham by feeding experiments with young albino rats. Based on similarity in the nutritive value of their proteins, the meat products examined were arranged in three groups in descending order as follows: (1) All samples of pork sausage, Braunschweiger-style sausage, and meat loaf, the proteins in these products having practically the same nutritive value as those in beef chuck and fresh pork ham; (2) all samples of Frankfurter- and Bologna-style sausage and one lot of scrapple; and (3) all samples of headcheese, liver sausage, fresh link sausage, and a lot of scrapple from another establishment.

Two foods found deficient in necessary cystine (*Illinois Sta. Rpt. 1929*, pp. 77-79).—Preliminary tests, conducted on rats by H. H. Mitchell and J. R. Beadles to determine the deficiency of various foods in cystine, showed that while white bread and beef fed at an 8 per cent level as the sole source of protein were not improved by the addition of cystine in amounts equivalent to 3 per cent of the ration, potatoes and navy beans were slightly improved and milk and canned green peas noticeably improved. The work with peas and milk was repeated on a larger scale with consistently favorable results. This shows that peas and milk are not capable of supplementing each other in a ration, since both possess the same amino-acid deficiency.

Nutritive value of ice cream, L. S. PALMER (*Amer. Jour. Pub. Health*, 19 (1929), No. 6, pp. 601-604, figs. 2).—The experiments reported, which were conducted in the animal nutrition laboratory of the National Dairy Council at Forest Lake, Minn., demonstrate the value of commercial ice cream of a standard composition of 38 per cent total solids and 12 per cent fat in supplementing a diet of low vitamin content, consisting of dry bread, potato flour, white corn, extracted casein, lard, dry cooked beef, oatmeal, sugar, bone meal, and salt. On the basal diet alone the growth of the rats was considerably stunted as compared with the breeding diet. On a mixture of two-thirds basal diet and one-third ice cream the rats grew better and were in better condition at the end of 44 weeks than on the breeding diet. On ice cream alone growth was better than on the basal diet and nearly as good as on the breeding diet.

The storage of manganese and copper in the animal body and its influence on hemoglobin building, R. W. TITUS and J. S. HUGHES (*Jour. Biol. Chem.*, 83 (1929), No. 2, pp. 463-467, figs. 3).—Further evidence is reported substantiating the view that not only copper but manganese is effective in the utilization of iron in hemoglobin building (E. S. R., 61, p. 90). Three lots of rats about 4 weeks of age were placed in individual galvanized iron cages and fed whole cow's milk ad libitum. Lots 1 and 2 received for 5 weeks supplements of 0.1 mg. of manganese in the form of chloride and 0.05 mg. of

copper as sulfate, respectively. At the end of this time the supplements were replaced by 0.5 mg. of pure iron in the form of chloride. Lot 3 received the iron supplement only through the entire period. The animals in the first two lots showed a gradual decrease in the hemoglobin content of their blood until the substitution of the iron for the manganese or copper, when the hemoglobin content of the blood immediately began to increase until in about 5 weeks it was practically normal. The animals in lot 3 gradually became anemic.

Canning of non-acid vegetables, O. D. ABBOTT (*Florida Sta. Rpt. 1928*, p. 96).—In this progress report (E. S. R., 60, p. 190) it is noted that two thermophilic groups of bacteria, a facultative and a nonfacultative type, have been found to be the cause of the flat, sour spoilage noted in some of the jars of canned vegetables sent to the laboratory.

Organisms associated with commercially prepared infant foods, G. J. and A. M. HUCKER (*Amer. Jour. Diseases Children*, 38 (1929), No. 2, pp. 310-313).—Samples of various proprietary infant foods secured in the open market have been examined at the New York State Experiment Station for the presence of streptococci of the hemolytic or viridans type, with practically negative results. It is suggested that "because of the probabilities that the raw products from which infant foods are manufactured may contain hemolytic streptococci, as well as the possibility of contamination by such organisms during the manufacturing process, it would seem advisable, however, that a routine control be established by the concerns over their respective products or by some central agency."

The number and type of bacteria in commercially prepared infant foods, G. J. and A. M. HUCKER (*New York State Sta. Tech. Bul. 153* (1929), pp. 28).—A representative series of samples of prepared infant foods was secured from the manufacturers and on the open market, and the numbers of organisms present were determined by plate culture, using the medium adopted by the committee for standard methods of milk analysis of the American Public Health Association (1928) and in some cases a medium containing a carbohydrate source of energy, a more available nitrogen source, and yeast extract. The number of colonies found varied from 10 to over 600,000 per gram of dried material, with an average of 20,000 per gram.

The principal organisms present in the samples examined proved to be of the spore-bearing type, many of which were thermophiles. The reconstituted forms of infant food contained the largest number of heat-resistant types of bacteria and Boilable Protein Milk the smallest total number of colonies which developed at either 37 or 56° C.

No attempt is made to interpret the significance of these findings with respect to the quality of infant foods, but it is suggested that the milk powders designed primarily for infant feeding should meet the same sanitary requirements as specially prepared infant foods. The following sanitary standards are recommended for all commercially prepared infant foods:

"(1) They should contain no hemolytic streptococci. (2) Twenty cc. of sterile milk, when inoculated with 0.5 gm. of the infant food and incubated at 37° for 10 hours, should show no visible peptonization. (3) They should contain less than 10,000 colonies per gram when the duplicate plates are incubated at 37° and 56° for two days. A medium containing tryptophane broth, peptone, yeast extract, and glucose is suggested for this determination."

The sanitary control of commercially prepared infant foods, G. J. and A. M. HUCKER (*New York State Sta. Tech. Bul. 154* (1929), pp. 16).—The feasibility of setting a standard of less than 10,000 colonies per gram for prepared infant foods, as noted above, is demonstrated in this report of the analysis of various samples of prepared infant foods obtained from one manufacturing

concern before and after the establishment of more rigid sanitary control measures and higher temperatures of sterilization. With 5 exceptions, 46 samples obtained from this concern showed bacterial counts of less than 10,000 colonies per gram after the introduction of these measures, while almost all had a content higher than 10,000 before the introduction of special sanitary control.

Growth in infants from the standpoint of physical measurements and nitrogen metabolism, I—III, A. L. DANIELS and L. M. HEJINIAN (*Amer. Jour. Diseases Children*, 37 (1929), No. 6, pp. 1128–1134, fig. 1; 38 (1929), No. 3, pp. 499–512).—Three papers are presented.

I. Creatinine (pp. 1128–1134).—Consecutive studies of creatinine excretion were conducted on 9 male infants between 2 and 8 months of age for varying periods of time with regular measurements of weight and length. In all cases the output of creatinine increased with age and appeared to depend to a marked degree on muscular activity, a sudden increase in most instances taking place between the third and sixth month.

The creatinine-weight coefficients were fairly comparable and consistent for a given infant, but the relation between creatinine and length appeared to be a more accurate measure of the child's physical development than the creatinine-weight coefficients or the height-weight relationship. Infants of the same length in general had the same creatinine-length coefficients irrespective of height and weight.

It is concluded that many more data are needed to confirm these findings and to determine the norms of children of different ages. "It is believed, however, that if such norms can be established, one will be in a position to judge better the physical development of children. This may lead to a more rational method of evaluating and treating the so-called undernourished child."

II. Creatine (pp. 499–506).—The results obtained in this phase of the investigation are summarized as follows:

"In a series of studies of the metabolism of 11 normal infants receiving artificial feedings of modifications of cow's milk, it was observed that the amount of creatine excreted bore no relation to age, development of muscle, as indicated by the amounts of creatinine eliminated, or to volume of urine. The intake of food was so controlled that the factor of possible depletion of carbohydrate was excluded. The results of the investigation seem to indicate that the creatinuria of infancy is related to the ingestion of protein. An increase in the urinary nitrogen, in general, was coexistent with an increase in the urinary creatine. It is suggested that creatine is an end product in the catabolism of certain precursors in the protein molecule, and bears no relation to the urinary creatinine, which is an end product of muscle metabolism."

III. Uric acid (pp. 507–512).—The excretion of uric acid in three of the subjects of the previous study was examined in its relation (1) to growth, (2) to food ingested, and (3) to the other nitrogenous constituents of the urine. "It was found that although the elimination of uric acid increased with increasing age, there was no close relationship between the excretion of urinary creatinine and that of uric acid, nor was there any apparent relation between the ingestion of protein and the excretion of uric acid, which averaged 12, 10.9, and 12.7 mg. per kilogram, respectively, for the three infants under observation. With these infants there appeared to be a closer correlation between height and the amount of uric acid excreted than between weight and the amount of uric acid excreted."

The composition of growth in infancy.—I, A premature infant, B. HAMILTON and M. MORIARTY (*Amer. Jour. Diseases Children*, 37 (1929), No. 6, pp. 1169–1176, figs. 2).—The retention of nitrogen, chlorine, phosphorus, calcium,

magnesium, sodium, and potassium of a premature infant were determined by methods previously described (E. S. R., 60, p. 289) in frequently repeated experiments for a period of 53 days during which the infant gained 1,425 gm. in weight. The retentions per kilogram of gain in weight were compared with the averages of published data on the composition of the body at birth.

The daily retention of calcium was of the same magnitude as that found in normal infants, but in proportion to growth gains was considerably less than at birth. This was true to an even greater extent of phosphorus. The retentions of sodium, potassium, chlorine, and nitrogen were high in comparison with the amounts in newborn infants. Negative magnesium balances obtained in three of the five periods.

"Perhaps the most probable interpretation of the results is that during the time of observation there was a progressive loss of lime salts from the bones an increase in body fluids, and a change in either the composition or the relative mass of the cellular tissues."

The relation of rate of growth in infants to diet, A. L. DANIELS, M. K. HUTTON, G. STEARNS, and L. M. HEJINIAN (*Amer. Jour. Diseases Children*, 37 (1929), No. 6, pp. 1177-1186, figs. 4).—A comparison is reported of the growth, as shown by gains in weight and in amounts of nitrogen, calcium, and phosphorus retained and creatinine eliminated, of two groups of infants receiving feedings of modified cow's milk, one with cod-liver oil and one without.

Those receiving the cod-liver oil weighed more at a given age than those receiving no supplement and, moreover, were considerably heavier than the accepted standards of infants of corresponding ages and birth weights. The increase in weight was accompanied by an increase in urinary creatinine, thus suggesting a better development of muscle. A more constant relationship was noted between the retention of nitrogen and excretion of creatinine than between body weight and creatinine.

The better physical development of the infants receiving cod-liver oil is thought to be due largely to the increased antirachitic value of the feedings, but it is admitted that vitamin A and vitamin B may have been contributing factors. The investigation is thought to indicate that the accepted standards of growth for infants are too low.

Nutrition study of school children, C. F. AHMANN (*Florida Sta. Rpt. 1928*, pp. 94, 95).—In this progress report data are tabulated on the percentages of underweight, dental caries, defective tonsils, eye disease, and hookworm in the children of four representative counties of Florida and the prevalence of various diseases and defects by sex in 1,183 of these children. This tabulation showed that 14.4 per cent of the boys and 17.9 per cent of the girls were 10 per cent or more underweight, 37.9 and 34.3 per cent, respectively, were anemic, 49.7 and 43.6 per cent with decayed teeth, 49.2 and 43.3 with defective tonsils, and 55.5 and 46 per cent suffering from hookworm.

Diets for the identification of food allergies, J. DALE and H. D. THORNBURG (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 7, pp. 505-512).—Two so-called "elimination" diets for the identification of food allergies have been developed by the authors upon the principle employed by Rowe (E. S. R., 60, p. 597). The diets, which are composed of 21 and 23 separate articles of food, respectively, with no articles in common except salt, sugar, and gelatin, are said to be adequate in protein, minerals, and vitamins for adults and in all the food factors except calcium and phosphorus for children. The allowance of these elements is considered to be fair though not optimal. Five menus for adults have been prepared from each list and menus for boys of 3 and 9 years, respectively, from the first list. The principles upon which the diets are based and the gen-

eral methods of using them are discussed, with many references to the original literature.

The vitamin content of German food materials.—I, Fruits and vegetables, A. SCHEUNEER (*Der Vitamingehalt der Deutschen Nahrungsmittel. 1. Teil, Obst und Gemüse. Berlin: Julius Springer, 1929, pp. [3]+37, figs. 3*).—This is the first of a series of reports on the content of vitamins A, B, and C in food materials of German origin as determined by the author and various collaborators at the Animal Physiological Institute of the University of Leipzig. Preliminary chapters on the significance and properties of the vitamins and on the technic employed in the present investigation are followed by brief summaries of the data obtained.

In the studies on vitamins A and B, rats were weaned at 3 weeks of age, kept for a week on a mixed diet, and then at weights of 40 or 50 gm. placed on the experimental diets for from 45 to 60 days. The vitamin A-free diet consisted of casein 18, palm oil 15, dry yeast 5, McCollum and Davis salt mixture 5, and starch 57 per cent. The constituents were rendered free from vitamin A by extraction, and in the later experiments vitamin D was supplied by irradiation of the diet or by the addition of irradiated ergosterol. The rats were kept on the diet until growth had ceased for 14 days and various symptoms of a deficiency had appeared. In feeding the material to be tested for vitamin A, an attempt was made to furnish sufficient for growth at somewhat less than optimal rates. From 3 to 4 animals were used for each food.

The B-free diet consisted of casein 20, palm oil 7, cod-liver oil 8, McCollum and Davis salt mixture 5, and starch 60 per cent. The rats were kept on this until growth ceased, from 14 to 20 days, and then were fed the material to be tested for the same length of time as in the experiments on vitamin A.

In the vitamin C studies the basal diet consisted of oats and market milk autoclaved for 1 hour. This material was fed the guinea pigs from the beginning.

The standard for comparison in the A studies was a good grade of butter, 0.5 gm. of which gave optimal growth, for B a dry brewery yeast giving optimal growth in 0.5-gm. daily amounts, and for C a green vegetable which, in amounts of 1 gm. daily, protected against scurvy and promoted good growth. If from 0.5 to 2 gm. of the food material being tested gave corresponding results, the vitamin content was classed as very good.

The materials tested included blackberries, strawberries, whortleberries, raspberries, currants, elderberries, gooseberries, apples, pears, apricots, cherries, peaches, plums, greengages, kale, savoy, white cabbage, beet greens, spinach, head lettuce, red cabbage, Brussels sprouts, cauliflower, green beans, wax beans, green peas, dried yellow peas, cucumbers, rutabagas, carrots, celery root, potatoes, kohlrabi, asparagus, and mushrooms. Most of the materials were tested not only raw but also cooked or canned.

In general the fruits with the highest content of vitamin A were those with the most pronounced color, such as blackberries, whortleberries, raspberries, red currants, dark cherries, blue plums, and greengages. All varieties of gooseberries were also rich in A. Fruits of lighter color contained only small amounts of A. In gooseberries, currants, and elderberries, vitamin A was localized chiefly in the seeds and skin, with but little in the juice. Vitamin B was present in all of the fruits tested, but in small amounts. In gooseberries and currants, vitamin B, like A, was localized in the seeds and skin. The vitamin C content varied widely in the different fruits. Some of the berries and some varieties of cherries were good sources. Apples were indicated as a good source of vitamin C on account of their cheapness and abundant use, but

peaches, pears, apricots, and plums contained little C. Commercially preserved fruit juices contained no appreciable amounts of C.

Among the raw vegetables, the green leafy vegetables were the richest sources of vitamin A. Raw carrots and chanterelles were good sources of A. Vitamin B was present, but in most cases in moderate amounts.

Ordinary household cooking and preserving were considered to have but little destructive effect on vitamins A and B. In canned and preserved fruits rich in vitamin C in the raw state the losses were not significant, but in fruits with a low content of vitamin C the amount left after canning was insignificant. The losses of vitamin C in vegetables were greater than in fruits. Attention is called, however, to the fact that the loss of vitamin C in potatoes following ordinary methods of cooking did not exceed 50 per cent, and that potatoes should be considered a good source of vitamin C.

Vitamins in canned foods.—VIII, Home canning and commercial canning contrasted in their effect on vitamin values of pears, M. M. KRAMER, W. H. EDDY, and E. F. KOHMAN (*Indus. and Engin. Chem.*, 21 (1929), No. 9, pp. 859–861).—This continuation of the series of papers previously noted (E. S. R., 62, p. 93) is a combined report of an extension to commercially canned products of the studies of Craven and Kramer at the Kansas Experiment Station on the vitamin C content of Kieffer pears (E. S. R., 57, p. 392), and of determinations at Teachers College, Columbia University, of the content of vitamins A, B, and C in Bartlett pears, raw and commercially canned.

In the Kansas experiments the Kieffer pears were tested in the raw ripe state and canned after four different treatments as follows: One lot of the peeled, halved, and cored fruit was held in a cold 2 per cent sodium chloride solution for approximately 12 hours, another lot was held in the salt solution for only about 30 minutes, and a third lot was subjected in 1 per cent salt solution to a vacuum of 28 to 28.5 in. for 25 minutes. The pears in all of these lots were green, but a fourth lot of ripe pears was given the second treatment. All four lots, after being filled into the cans, were covered with boiling water and the cans passed through the steam exhaust box at a temperature of 180° F. and then closed and processed in boiling water for 12 minutes.

Lots 1 and 3 of the canned green pears were equivalent in vitamin C value to the fresh raw pears, from 15 to 20 gm. being required for protection. Lot 2 showed some destruction of vitamin C, as from 20 to 30 gm. were required for protection. The fully ripened canned pears were low in their content of vitamin C, full protection not being secured with 30 gm.

The Bartlett pears were canned and fed raw only in the ripe state. Of the raw pears 15 gm. was inadequate. Canning did not appear to destroy a large portion of the vitamin C, as 20 gm. of lots 2 and 3 were almost protective. Better results were not secured with larger amounts. Bartlett pears, raw or canned, were relatively low in vitamins A and B.

The antirachitic action of a protein-free egg yolk extract (Helicocitin) [trans. title], H. STEDDEL (*Klin. Wchnschr.*, 8 (1929), No. 18, pp. 830–833, figs. 5).—Helicocitin, a commercial protein-free extract of the oil of egg yolk, is reported to be rich in vitamins A and D.

Is ossification influenced solely by ultra-violet light? R. A. DUTCHER and H. E. HONEYWELL (*Science*, 70 (1929), No. 1807, pp. 173, 174).—Young rats receiving the Steenbock-Black rachitic ration and exposed 8 hours a day to the light of 100-watt Mazda bulbs were found at the end of 21 days to have a much higher content of ash in the femurs than litter mates exposed to the diffused laboratory light, and these in turn higher than litter mates kept in dark cages protected by black muslin cloth. The lowest content of ash was found in the animals kept in cages protected by cardboard covers.

An additional experiment covering 35 days yielded higher results in the case of rats exposed to the light of the Mazda bulb 24 hours a day than of litter mates receiving 2 drops of cod-liver oil daily, followed in decreasing order by those exposed to the laboratory light and those kept in dark cages.

It is concluded that light rays longer than ultra-violet possess ossifying power.

Vitamin A in animal nutrition, O. D. ABBOTT (*Florida Sta. Rpt. 1928, pp. 91-94*).—Included in this progress report is a summary of the results obtained in the examination of histological sections of rats on a vitamin A-deficient diet. Sections of the stomachs showed an absence of mucosa, disintegration of much of the muscular tissue, and in most cases ulceration along the elevated ridge dividing the rumen from the glandular part of the stomach. Sections from the testes showed progressive degeneration of the germinal epithelium of the seminiferous tubules, finally resulting in loss of the germ cells. The livers showed a spotted appearance and in the more advanced cases were gray in color.

Aseptic operations showed almost complete disappearance of the great omentum.

Vitamin A content of the green and white leaves of market head lettuce, M. M. KRAMER, G. BOEHM, and R. E. WILLIAMS (*Jour. Home Econ., 21 (1929), No. 9, pp. 679, 680*).—A comparison of the vitamin A content by the Sherman-Munsell method of the whitest leaves from the center of heads of California Iceberg lettuce with the greenest outer leaves gave unit values of 0.6 gm. for the white leaves and between 0.015 and 0.02 gm. for the green leaves, thus showing that the outer leaves of such head lettuce contain 30 or more times as much vitamin A as the innermost leaves.

Assimilation of vitamin A in the presence of mineral oil, J. O. ELY, H. E. HONEYWELL, and R. A. DUTCHER (*Pennsylvania Sta. Bul. 243 (1929), p. 5*).—Further evidence has been obtained confirming the conclusion noted previously (*E. S. R., 58, p. 88*) that the rat is unable to utilize vitamin A from butterfat in the presence of mineral oil. It has also been demonstrated that this is not due to the laxative effect of the mineral oil, and no evidence has been obtained to support the theory that intestinal permeability has been affected adversely by the mineral oil.

Vitamin A technique as influenced by yeast from various sources, H. E. HONEYWELL, R. A. DUTCHER, and J. O. ELY (*Pennsylvania Sta. Bul. 243 (1929), p. 5*).—The authors report that the curative response of rats to a constant supply of vitamin A is proportional to the quantity and quality of the vitamin B complex, and that consequently quantitative work on vitamin A is not possible unless the potency of the yeast used in the experimental diet is determined in advance.

Vitamin B requirements in infancy, A. P. BLOXSOM (*Amer. Jour. Diseases Children, 37 (1929), No. 6, pp. 1161-1168*).—This report from the department of pediatrics of the Vanderbilt University School of Medicine shows a remarkable increase in the rate of growth of a small series of premature and other infants following the daily administration of brewers' yeast as a source of the vitamin B complex. The dried yeast was mixed with 2 parts of water and fed twice daily in amounts of 1 cc. to infants weighing up to 4 lbs., 2 cc. to those weighing from 4 to 8 lbs., 4 cc. from 8 to 12, and 8 cc. from 12 to 25 lbs. Coincident with the increase in rate of gain, there was a change in disposition of the infants, the fretful ones becoming satisfied and contented. The improvement in condition was such that the stay in the hospital was considerably shortened as compared with that of infants not receiving this treatment.

The vitamin C content of cucumbers and cucumber pickles, B. H. THURMAN and H. W. VAHLTEICH (*Jour. Home Econ.*, 21 (1929), No. 7, pp. 510-513, figs. 2).—In this comparison of the vitamin C content of fresh cucumbers and fresh and salt stock cucumber pickles, 4 gm. daily of the fresh cucumbers gave complete protection against scurvy to guinea pigs weighing 300 gm. or more at the beginning of the experiment. Smaller amounts were not tested, as the minimum protective dose of cucumbers previously reported in the literature was said to be in the neighborhood of 10 gm. The fresh cucumber pickle was made by cooking sliced fresh cucumbers with vinegar, sugar, salt, and spices according to the commercial method for making what is known as Bread and Butter pickles. Salt stock cucumbers were drained, sliced, washed with water to remove most of the salt, and pickled in the same way as the fresh cucumbers. The smallest dose of the pickles fed was 6 gm. and this proved completely protective in the case of the fresh pickles, but amounts as large as 16 gm. daily of the salt stock pickles gave no protection.

Desiccated stomach in the treatment of pernicious anemia, C. C. STURGIS and R. ISAACS (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 10, pp. 747-749, figs. 2).—Fresh whole hog stomach, desiccated to the extent that 30 gm. of the dried substance represented 190 gm. of fresh tissue and the same material defatted by petroleum benzine, have given results comparable with those obtained with liver and liver extracts in the treatment of 3 consecutive cases of pernicious anemia. From the limited amount of data available, it is suggested that stomach tissue per gram of fresh material is more active than liver.

An antianemic factor in desiccated stomach, E. A. SHARP (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 10, pp. 749-753).—A further discussion of the use of desiccated whole hog stomach in the treatment of pernicious anemia.

The management of the ambulatory diabetic child, W. S. COLLENS and H. G. GRAYZEL (*Amer. Jour. Diseases Children*, 38 (1929), No. 2, pp. 275-293, figs. 2).—This discussion of the system employed in the Jewish Hospital of Brooklyn in the management of diabetic children includes useful tables for the calculation of diet formulas which are so constructed as to furnish sufficient calories to provide for the total heat production of the body, sufficient protein for the wear and tear of the tissues and for growth, a minimum amount of available dextrose, and a ketogenic-antiketogenic ratio not greater than 1.5 : 1.

TEXTILES AND CLOTHING

Artificial soiling of cotton fabrics preparatory to laundering studies, A. E. HILL (*Jour. Agr. Research [U. S.]*, 39 (1929), No. 7, pp. 539-550).—A comparative study of materials indicated Oildag for the black constituent of soiling mixtures in laundering experiments. Samples soiled with mixtures containing this material are of uniform and reproducible brightness. A soiling mixture containing Oildag, olive oil, tallow, and mineral oil includes representatives of all constituents of natural soiling except albuminous matter and stains. A small agitator type of washing machine used in applying the mixture deposits the soil uniformly over the surface of each fabric sample, furnishes samples of similar brightness, and with the same procedure enables the production of a second set of the same uniformity and brightness. Weighing, either in a humidity room or in a conditioning oven, was unsatisfactory for determining the amount of soil removed. A photometric method seemed preferable.

MISCELLANEOUS

[**Annual Report of Florida Station, 1928**], W. NEWELL ET AL. (*Florida Sta. Rpt. 1928, pp. 123-IV, figs. 11*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1928, and departmental reports, the experimental features of which, not previously reported, are for the most part abstracted elsewhere in this issue.

A year's progress in solving farm problems in Illinois: [Forty-second Annual Report of Illinois Station, 1929], compiled and edited by F. J. KEILHOLZ (*Illinois Sta. Rpt. 1929, pp. 270, figs. 47*).—This contains the organization list and a summary of the work during the year ended June 30, 1929. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

Forty-second Annual Report of the Pennsylvania Agricultural Experiment Station, [1929], [R. L. WATTS ET AL.] (*Pennsylvania Sta. Bul. 243 (1929), pp. 47, figs. 11*).—This bulletin discusses briefly the work of the station for the year ended June 30, 1929, including a financial statement for this period. The experimental work recorded and not previously noted is for the most part abstracted elsewhere in this issue.

Forty-second Annual Report [of the Vermont Station, 1929], J. L. HILLS (*Vermont Sta. Bul. 302 (1929), pp. 29*).—This contains the organization list, a report of the director for the fiscal year ended June 30, 1929, and financial statements for the fiscal years ended June 30, 1928, and June 30, 1929. The experimental work reported is for the most part abstracted elsewhere in this issue.

NOTES

Florida Station.—The station is undergoing considerable expansion. Two new field laboratories have been established, one field laboratory has been changed to a substation, and the work of another substation has been enlarged.

One of the new field laboratories is located at Leesburg in Lake County and is for the purpose of studying watermelon diseases and insects. Dr. M. N. Walker, associate plant pathologist, has been placed in charge of the disease study, and C. C. Goff has been appointed assistant entomologist to conduct the insect study. The other field laboratory is located at Pierson in Volusia County, and its principal purpose is the study of insects of ornamentals, principally *Asparagus plumosus* ferns and bulbs. Dr. J. W. Wilson has been appointed assistant entomologist for this work.

The field laboratory at Homestead in lower Dade County has been converted into a substation for the study of subtropical horticulture. Additional land has been acquired, and buildings are being erected. L. R. Toy has been appointed assistant horticulturist at this station.

By legislative act the Tobacco Substation at Quincy in Gadsden County has been made a general branch station and empowered to take up studies of the principal crops of west Florida.

R. N. Loddell has been appointed assistant entomologist and assigned to work at the Everglades Substation, where one of his chief projects will be the introduction of parasites of the cane borer.

New York State Station.—E. V. Shear, jr., associate in research (plant pathology), for several years in charge of the plant disease work of the Hudson Valley fruit investigations, has resigned to accept a position with the U. S. Department of Agriculture, with headquarters in the Pacific Northwest, and effective April 1. E. L. Green, assistant chemist in the Washington Station, has been appointed associate in research (chemistry) and has entered upon his duties.

West Virginia Station.—In order to provide permanent experimental facilities in the orcharding section of the State, a tract of 160 acres of land near Kearneysville has been purchased, financed in part by contributions from fruit growers. The farm which has been acquired contains well-adapted buildings and an orchard of 15 acres. F. J. Schneiderhan, assistant plant pathologist, and Edwin Gould, assistant entomologist, are to be located at this substation, with the former in charge and others to be added as the work develops.

Inter-American Conference on Agriculture, Forestry, and Animal Industry.—Plans are being completed for this conference, recommended by the Sixth International Conference of American States at Habana, and it will be held in Washington, D. C., from September 8 to 20, 1930. According to a recent announcement by the Secretary of State, the discussions are to have as their principal aim the definition of the outstanding problems in the several countries which may be solved by cooperation, the consideration of policies and methods of procedure to be followed in a cooperative attack on these problems, and to decide on the organization to be set up, the location of research stations or laboratories, and questions of financial support.

EXPERIMENT STATION RECORD

VOL. 62

APRIL, 1930

No. 5

At a time when much is being said and more is being thought regarding cooperation in agricultural research, it may be of interest to note that numerous more or less elaborate ventures into this relatively uncharted field are under consideration. One of the most significant of these has recently been under discussion in the British Empire, and looks toward a closer coordination of work and a broader basis of inquiry into problems associated with the subject of agricultural meteorology.

The immediate opportunity for the development of a cooperative program in this important but somewhat vaguely defined field came with the holding in London last August of a conference of Empire meteorologists. Through the initiative of the Empire Marketing Board, a body established in 1926 with large powers and generous appropriations to foster the economic development of the Empire by furthering the marketing of Empire products in Great Britain, there was arranged in connection with the conference an agricultural section to which the various governments of the Empire were invited to send special delegates. The organization of this section was intrusted to the British Agricultural Meteorological Committee, comprising representatives of the British Ministry of Agriculture and Fisheries, the Department of Agriculture for Scotland, the British Meteorological Office, and the various dominion, colonial, Indian, and foreign offices. Its sessions were attended by many of the delegates to the main meteorological conference and by an approximately equal number of agricultural delegates. The overseas representation included 7 dominions, 18 colonies, India, the Sudan, and Egypt, and there were 80 meteorologists and agricultural workers from the home countries of England and Wales, Scotland, and Northern Ireland.

In this way there were there brought together for the first time a goodly number of the leading workers in the Empire in their representative lines for a discussion of problems of common concern. The meetings of the section continued from August 28 to September 4, 1929, and the detailed report of the papers and proceedings has recently become available in printed form. This report furnishes

striking evidence both of the progress being made in agricultural meteorology and the active interest in its possibilities as a field for cooperative endeavor. The latter phase was especially stressed in the introductory address of the presiding officer, Sir Napier Shaw of the Meteorological Office, who emphasized the necessity for close cooperation between meteorologists and workers in the various agricultural sciences in "the study of the effects of different weather factors on the soil, crops, animals, pests and diseases, and agricultural processes generally," and expressed the hope that future conferences would still further develop such cooperation with increasing benefit to those concerned.

The papers which were presented and discussed were unusually informing and suggestive, and various significant definitions and resolutions were adopted. These showed, first of all, that the section took a broad view of the field of agricultural meteorology, including in it not only climatic and weather conditions as related to forecasting crop yields but various aspects of the response of plants and animals to environment. The section also considered and went on record as favoring, among other things, more adequate meteorological observations in connection with experimental and demonstration work, particularly that on cultivation, manuring, and varieties of crops; further studies of the relation of climate and soil to growth of fruits and their resistance to diseases and pests and to frost damage; studies of climatic causes of variation in number and distribution of wild animals; more thorough study of weather conditions in the immediate vicinity of the growing crop; and further development of investigations furnishing a basis for forecasting outbreaks of plant diseases or insect pests and probable yields of crops. An especially significant feature of the discussions and proposals was the emphasis placed on the importance of studying the conditions of temperature, moisture, sunlight, and the like, immediately surrounding the growing plant, as is done in the so-called microclimatic studies which are now receiving much attention. There were also joint sessions devoted to the discussion of general climatology and seasonal forecasting.

The breadth of the section's conception of the field of research in agricultural meteorology and the service it may render is indicated in its summary of the manifold practical agricultural uses to which meteorological information may be put. This summary is as follows: "(1) The use of weather forecasts in planning farming operations: day by day, e. g., the employment of labor on indoor or outdoor work: planning of plowing, seeding, spraying, and harvesting; (2) the use of climatological data in planning the whole economy of the farm, e. g., proportion of arable and pasture; kinds and varieties of

crops; kinds, numbers, and management of livestock; amount and kinds of machinery; amount of labor and ratio of permanent to casual labor; (3) the use of climatological data in special agricultural engineering problems, such as use of wind and water power, and provision of water; (4) the use of the results of past crop-weather research, in conjunction with current meteorological records, for the purpose of forecasting yields of crops; (5) the use of the results of past research into the effects of climate and weather on insect pests and fungus diseases, in conjunction with current meteorological records, to forecast seasonal occurrence and mass outbreaks of pests and diseases; (6) the employment of protective devices against adverse weather."

As an aid to the practical conduct of the work, directions for obtaining and recording the data necessary to ascertain the effect of weather on crops have been prepared by the Agricultural Meteorological Committee. These directions have been published in the form of an observers' handbook, and have been put into effect by various cooperating institutions in England, Wales, and Scotland. They provide for recording meteorological conditions and progress in growth and yields of crops and also for phenological observations. It is intended that when satisfactory records have been obtained over a sufficient number of years they will be subjected to "rigorous statistical examination to ascertain any correlations that may exist between the different sets of data." Current summaries of the observations will be published in the monthly agricultural meteorological reports of the Ministry of Agriculture and Fisheries. The scheme provides for systematic observations on wheat, barley, oats, turnips, swedes, meadow hay, apples, plums, currants, and peas, but is especially elaborate for wheat. It also includes general phenological observations on wild flora and fauna, as well as a special form of phenological study based on observations on plants from a common stock grown under uniform conditions in small gardens.

The British scheme is apparently similar to that proposed and put into effect in Russia by Brounov many years ago, and to that more recently established by G. Azzi in Italy. Its purpose is to secure coordinated data on meteorological conditions and crop growth and yields to aid in answering questions regarding "the best times and methods for soil cultivation operations, the best systems of manuring and times of application of manures, crops and their varieties best suited to given weather conditions, rates and times of sowing, origin of seed and treatment of seed crop, the best methods for tiding plants over critical periods, forecasting of attacks of insect and fungus pests and measures for prevention of damage, measures for prevention of damage from harmful weather such as heavy frost,

the best times and methods of harvesting, the best times and methods of storage for securing good quality of produce, [and] forecasting of yields of crops in general."

In editorial comment in the *Record* on studies of the relations of climate and weather to crop production at the time of the organization of a Division of Agricultural Meteorology in the United States Weather Bureau in 1916 (E. S. R., 34, p. 601), it was stated that there had then been distinct progress in "(1) the organization and correlation of statistical data on weather conditions and crop growth already available in large amount; (2) the organization of more extensive and systematic effort to secure exact data along this line by all interested agencies; and (3) special studies of the adjustment of plants and animals to their atmospheric environment, requiring the cooperation of the biologist with the meteorologist." The outlook for further progress was considered hopeful. The British conference furnishes concrete evidence that this hope was justified and that the possible field of profitable investigation has been greatly enlarged.

Discussing research in "the still infant science of agricultural meteorology," Sir Daniel Hall said in 1923: "The meteorologists are still in the main waiting for a lead from those concerned with the agricultural side of the problem, and that lead can hardly be forthcoming until further research has been carried out on the reaction of the crops to the various elements of weather." The London conference appears to have pointed out many ways in which the meteorologist may cooperate effectively with those interested in the agricultural phases of the subject.

Especially notable contributions to agricultural meteorology of late are the work of Azzi in agricultural ecology, the development of the bioclimatic law of Hopkins, the work of Garner, Allard, and others on photoperiodism, and the so-called microclimatic studies which have recently been reported. Fisher of Rothamstead has also made valuable contributions to methods of correlating climatic and other factors with crop yields.

In connection with the agricultural ecological service of Italy, Azzi has done outstanding work on the climatology of wheat, not only in Italy but throughout the world. This service was established to make a "systematic study of the physical environment in which agriculture is practiced with a view to determining by a well-defined method the principles governing the adaptation of crops to the climate of the different physiographical regions." It consists of a central bureau and a network of ecological stations as follows: "(1) First-class stations where parallel observations are made on

the course of meteorological phenomena in the air and at various depths in the soil, and on the development of the plants and varieties according to the instructions received from the central bureau; (2) second-class stations where meteorological observations in the air and observations of plant growth are made; (3) supplementary stations. Here independent studies are carried out without the aid of special instruments on the growth of plants and crop yield in connection with weather conditions."

The proposed applications to be made of the results of the studies with wheat are as follows: " (1) Agronomy: Determination of the yield of the varieties grown in a district under various conditions of soil and climate, never losing sight of the fact that yield is the result of a relation between productivity and resistance to adverse conditions; (2) plant morphology and physiology: Determination of the physiomorphological characteristics as connected with the expression of economic characters; choice of pure lines in the ecologic sense; (3) genetics: Individualization of the genetic factors which determine the above-mentioned characteristics; crossing of varieties in the ecologic sense; (4) ecology: Determination of the ecological units and production of the best combinations with the object of obtaining the maximum yield." Out of the service have grown not only exhaustive studies of the climatology of wheat, but data which make it possible to define certain fundamental principles and basic problems of agricultural ecology in general.

As already stated, the British plan includes systematic phenological observations. Hopkins has pointed out the significance and value of such observations and has formulated a bioclimatic law "founded on the determined country-wide average rate of variation in the time at which periodical events occur in the seasonal development and habits of plants and animals at different geographical positions within the range of their distribution. Other things being equal, this variation is at the rate of four days for each degree of latitude, 5° of longitude, and 400 ft. of altitude." This law was developed from observations on periodical events in the seasonal history of forest insects with special reference to their effective control, but it is also thought to have important applications in general farm practice.

Investigations in photoperiodism and the numerous studies of the effect of sunlight on growth and health of animals and the vitamin potency of foods and feeds point to important ways in which the meteorologist can effectively aid those engaged in other lines of agricultural research. They indicate especially the importance of systematic and widespread observations on the amount and intensity of sunlight.

The London conference reflected in marked degree the present tendency to use to a greater extent experimental methods of studying specific problems of response to environment which require the close cooperation of the meteorologist and other investigators in agricultural science. The opportunities for effective cooperation and the number of important unsolved problems which might be profitably attacked in this way appear to be almost unlimited. It is encouraging to note that not only are the possibilities of speedier and more broadly applicable findings through joint action becoming increasingly recognized but that after careful consideration definite programs are being formulated and entered upon which look to cooperation as a vital element in their plan of attack. There will be keen interest in observing the practical achievements from such undertakings, and if they succeed the movement to utilize the cooperative principle more frequently and more fully will be measurably stimulated.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

The chemistry of casein (*New York State Sta. Rpt. 1929, pp. 43-45*).—Report is made of an investigation carried out under a grant from the International Education Board in the laboratory of T. Svedberg, University of Upsala, Sweden.

Casein prepared either by the Hammarsten or by the Van Slyke and Baker method was found to consist not of a homogeneous chemical individual but of a mixture of substances, according to the results of the ultra-centrifuge experiments here noted.

By extracting crude casein with hot acidified 70 per cent alcohol it was found possible to dissolve out one distinct chemical individual, to which, by means of the centrifugal procedure indicated, were assigned a molecular weight of 376,000, a specific sedimentation velocity of 11.72×10^{-13} cm., and a diffusion constant of 3.56×10^{-7} cm. It was further found that "by fractionation with certain mineral salts we are able to separate the residue of the mixture of proteins in crude casein still further. From these studies we were able to show that we were dealing with two other proteins of molecular weights 95,000 and 188,000, respectively, each with a characteristic sedimentation value."

Attention is drawn to the fact that the two larger molecular weight figures are almost exactly twice and four times, respectively, the smaller value, and it is considered that "this indicates quite forcefully that the more complex species may be chemically related to the simpler one and possibly formed from it through the process of polymerization or association."

The application of the antimony electrode to the determination of the pH value and the lime requirement of soils, W. H. HARRISON and P. N. VRDHACHALAM (*India Dept. Agr. Mem., Chem. Ser., 10 (1929), No. 4, pp. 157-167, pls. 2, figs. 2*).—The antimony electrode proposed by Uhl and Kestranek (*E. S. R., 49, p. 803*) and employed for soil pH determinations by Snyder (*E. S. R., 59, p. 709*) was studied with a view especially to the development of a portable apparatus sufficiently simple and convenient for field work on soils. An apparatus considered to meet the indicated specifications is illustrated.

The antimony electrode itself was found to furnish a stable and reliable pH indicator system, and is stated to have given accurate results both in stirred and in still solutions, although in the latter case the readings are admitted to have been "somewhat higher than those found with stirred solutions." The relation between the pH and the electrical potential was, however, "of a simple character expressed by the formula $E = a + b(\text{pH})$." Of importance in the design of the field apparatus was the observation that "the pH values obtained by dipping an antimony electrode into moistened soil which is connected by a suitable salt bridge to a saturated calomel electrode are almost identical with those obtained by the hydrogen electrode in soil emulsions."

With respect to the accuracy of the results shown it may be noted that the discrepancies between the values given by the antimony electrode in moist soil

and those obtained with the hydrogen electrode in suspensions of the same soils ranged from 0.01 pH to a single case of a disagreement of 0.30, other differences amounting to 0.21 pH or less.

A method for the determination of total carbon and also for the estimation of carbon dioxide evolved from soils, A. F. HECK (*Soil Sci.*, 28 (1929), No. 3, pp. 225-233, pl. 1, figs. 3).—The carbon dioxide is absorbed by 0.5 N sodium hydroxide in a simplified form of trap, the carbonate is precipitated at the conclusion of the run by the addition of an excess of 2 N neutral barium chloride, and the excess alkali is titrated with 0.5 N hydrochloric acid, with phenolphthalein as indicator.

It was found possible to complete a determination of total carbon in about 45 minutes, while determinations of carbon dioxide (as evolved from soils, etc.) could be carried out at the rate of about 10 to 20 determinations an hour.

For the determination of the rate of evolution of carbon dioxide from organic materials in the soil, a battery of 42 evolution flasks and traps operated by one aspirator and attached to a single purification train for entering air is shown.

A method for the preparation of blood filtrates for analysis, M. SOMOGYI (*Soc. Expt. Biol. and Med. Proc.*, 26 (1929), No. 5, pp. 353, 354).—The use of zinc salts for the precipitation of the blood proteins is stated to have resulted in a filtrate containing fermentable sugar as the only substance present capable of reducing alkaline copper solutions.

"The reducing substances other than sugar—responsible for the 'residual reduction' of fermented blood filtrates—are precipitated along with the proteins, so that sugar determinations in zinc filtrates give true blood sugar values."

Reagent I was made up of 12.5 gm. of zinc sulfate heptahydrate, 125 cc. of 0.25 N sulfuric acid, and water to make 1 liter. Reagent II consisted of 0.75 N solution of sodium hydroxide, it being required that 25 cc. of I should take, when titrated with II, 3.35 to 3.40 cc. of the titrant to bring phenolphthalein, used as an indicator, to a permanent pink color.

A 1:10 filtrate was prepared by adding 1 volume of blood to 8 volumes of reagent I, followed by volume of reagent II, after which, the mixture having been shaken well and allowed to stand for a few minutes, the material was filtered through a dry paper. For the preparation of filtrates bearing other proportions to the volume of the original blood samples, different concentrations of the two reagents and other slight modifications in the procedure are described.

The nonprotein nitrogen values were found lower in the filtrates from zinc precipitation than in those from precipitation by tungstic acid.

A practical method for fat determination in milk, B. SINGH (*Jour. Cent. Bur. Anim. Husb. and Dairying, India*, 2 (1929), No. 4, pp. 178, 179).—In this method of testing milk for fat 11 cc. of milk is placed in a Gerber tube and 5 cc. of Fehling solution B added. One cc. of a mixture of 55 parts of isobutyl alcohol and 45 parts of methyl alcohol is added, the tube corked, inverted, and shaken gently, after which the tube is almost completely immersed in a water bath at 80° C. The tube is removed from the bath when the liquid inside is deep orange, shaken, and replaced in the water for 3 minutes. The cork is then removed, 5 cc. of hot water poured down the sides of the tube, the cork is replaced, and the tube inverted gently and again placed in the water bath. In a short time the fat column appears and is easily read on the graduated scale.

The advantages of this method are that it is economical, needs no centrifuge or sulfuric acid, does not require constant attention, and is suitable for field work.

METEOROLOGY

Organization of agricultural meteorology and the climate of Indo-China [trans. title], G. WÉRY (*Compt. Rend. Acad. Agr. France*, 14 (1928), No. 30, pp. 1003-1006; abs. in *Internatl. Rev. Agr. [Rome]*, *Mo. Bul. Agr. Sci. and Pract.*, 20 (1929), No. 8, p. 297).—This is a brief note on two papers by P. Carton, relating to the reorganization of the meteorological service of Indo-China in 1926, to include not only pure meteorology but also climatology, agricultural meteorology, and ecology, as well as seismology, and to a study of the climate of Indo-China. It is stated that the climatological system now includes about 50 climatological stations and 375 rain gage stations. It is suggested that planters might help in the development of this service by installing equipment for observations on their own farms. Reference is also made to a collection of climatological maps which have been prepared for the use of planters.

Phenological observations in 1928 [trans. title], H. BOS ET AL. (*Landbouwk. Tijdschr. [Amsterdam]*, 41 (1929), No. 499, pp. 754-780, pl. 1, figs. 3).—This article reports the continuation of meteorological and phenological observations relating to plants, birds, and insects and gives a brief account of the annual meeting of the Netherlands Phenological Society at Utrecht, June 9, 1929.

Long range rainfall forecasting from tropical (Darwin) air pressures, E. T. QUAYLE (*Roy. Soc. Victoria, Proc.*, n. ser., 41 (1929), No. 2, pp. 160-164, figs. 2; abs. in *Sci. Prog. [London]*, 24 (1929), No. 94, pp. 240, 241).—The forecasts discussed in this article are based on the correlation found to exist between two-monthly means of pressure at Darwin, Northern Territory, Australia, and the rainfall of the succeeding two months in northern Victoria as measured at 10 representative stations.

It is stated that the correlation between the June-July air pressure at Darwin and the August-September rainfall in northern Victoria appears to be sufficiently high to suggest possibilities of predicting flood or drought conditions at a time when rainfall has an almost "critical value in cereal production, as well as determining the state of spring and summer pastures." Predictions of rainfall above or below the average showed an accuracy of 82 per cent.

Science surveys the snows, R. STEWART (*Nature Mag.*, 13 (1929), No. 3, pp. 162-164, figs. 4).—The development of methods of measuring mountain snow cover and estimating the spring-summer run-off of mountain streams available for irrigation, power, and like purposes, based on the work of J. E. Church (*E. S. R.*, 55, p. 116), is described.

Rainfall maps of Wisconsin and adjoining States, E. R. MILLER (*Wis. Acad. Sci., Arts, and Letters, Trans.*, 24 (1929), pp. 501-508, figs. 4).—Maps based upon new computations of the average rainfall are given, with references to earlier maps and discussions of the rainfall of Wisconsin.

Rainfall characteristics and their relation to soils and run-off, C. S. JARVIS (*Amer. Soc. Civ. Engin., Proc.*, 56 (1930), No. 1, pt. 1, pp. 3-47, figs. 7).—This article summarizes "information regarding precipitation and its occurrence in various countries and latitudes: its relation to soils and run-off; the vegetative, topographic, and physiographic features of the watersheds; and the resultant influence on designs of drainage structures and channels."

Precipitation records for the principal stations throughout the world are assembled in a table showing averages and observed variations. The sources of the data are cited.

SOILS—FERTILIZERS

Methods for the examination of soils, J. A. PRISCOTT and C. S. PIPER (*Aust. Council Sci. and Indus. Research Pamphlet 8 (1928), pp. 52, figs. 9*).—A system of survey and of sampling methods, mechanical analysis, and chemical examination designed to unify procedure in the study of soils within the Commonwealth of Australia is detailed under the following principal captions: Field methods, preparation of sample, mechanical analysis, chemical analysis, and laboratory examinations required for soil surveys.

Soil profile studies.—I, **Soil as an independent body and soil morphology**, J. S. JOFFE (*Soil Sci., 28 (1929), No. 1, pp. 39-54*).—The author presents, as a contribution from the New Jersey Experiment Stations, an historical and critical review, in which the development of the science of the soil as an independent science is discussed, and the theories with respect to the soil and the various schools of soil genesis are reviewed with special reference to the Russian school from the time of Dokuchaev to the present. Marbut's and Shaw's definitions of soil (*E. S. R., 60, p. 512*) are critically analyzed, and a modification of Marbut's definition is suggested. It is further suggested that there be recognized as a special branch of soil science the study of buried soils, under the name either of paleopedology or of paleodaphology. The subjects of soil morphology and of the soil profile are also reviewed and discussed, and a bibliography of 77 items is appended.

The ultimate natural structure of soils, G. J. BOUYOUCOS (*Soil Sci., 28 (1929), No. 1, pp. 27-37*).—Soils allowed to dry in their natural state and slaked or disintegrated in a relatively large quantity of water were found to break down into particles or granules which strongly resisted further comminution. Further conclusions with respect to the significance of the experiments reported are thus stated:

"Since the size of the particles and granules into which soils slake in water has such marked stability, it is believed that these particles and granules constitute the natural, ultimate structure of soils. In other words, when natural, dry soils are placed in excess of water they slake into their ultimate, natural structure. . . . By means of the hydrometer method it is possible to make a mechanical analysis of this natural, ultimate structure and thereby ascertain the size and proportion of the various particles and granules. In other words, it seems that it is as possible now to determine the texture of the natural, ultimate structure of soils as it is to determine the ultimate size of particles.

"The experimental data presented would seem to support those views. It would appear that this natural ultimate structure of soils ought to form the basis for the study of many soil physical properties such as percolation, penetration, etc."

The laws of soil colloidal behavior, I. S. MATTSO (*Soil Sci., 28 (1929), No. 3, pp. 179-220, figs. 3*).—The subjects taken up are negative adsorption; the Hofmeister series; the Donnan equilibrium; the valence effect; the theory of swelling and the influence of valence; the distribution of ions in a bentonite gel; the relation between valence and swelling; the effect of the hydration of ions on the Donnan distribution and on the swelling; the effect of colloid concentration on the ion distribution in the sodium sulfate bentonite system; the micellar structure; the behavior of electro dialyzed bentonite at various degrees of saturation with sodium hydroxide; the influence of the nature of the exchangeable cation and of the composition of the colloid; viscosity; plasticity; and swelling, viscosity, and potential difference.

In the presentation of the experimental data bearing upon these factors in colloid behavior the theoretical considerations involved are discussed rather fully, with some mathematical analysis of the quantitative relations.

Ions which do not combine with the soil colloids and are not positively adsorbed by them were found to be negatively adsorbed—to be present, that is, in greater concentrations in the exterior solution than in the solution within the gel, after the establishment of equilibrium. Specific examples are given of the relative degrees of negative adsorption of the chlorine ion in various chloride systems and of a number of anions in solutions of sodium salts. In relating this observation to the theoretical considerations believed to be involved, it was found that "the application of the equilibrium formulas on the valence effect showed a fair agreement between theoretical and observed differences." It was shown that the equilibrium equation demands a valence effect of anions as well as of cations, and the experimental data were found to confirm this theoretical conclusion.

The author finds the colloidal micelle comparable to a living organism in that "it reacts to any change in the surrounding medium only more quickly because it possesses no membrane. Remove the water and the micelle is destroyed, leaving an inert particle comparable to the spore of an organism. This process is reversible. In dilute solutions . . . it swells, in strong solutions . . . it shrinks, thus striving to maintain a definite osmotic pressure and potential difference with respect to the outside solutions."

Emphasis is also placed upon the distinction which must be recognized as between the external and the micellar forms of soil solution. "The micellar solution is an integral part of the micelle. Any attempt to remove this solution by pressure or by any other means must fail."

Colloidal properties of Willamette Valley soils, R. E. STEPHENSON (*Soil Sci.*, 28 (1929), No. 3, pp. 235-247).—The determination by horizons of the colloid contents of 9 soil series is described in this contribution from the Oregon Experiment Station, together with the separation from each of the 3 horizons of one (Chehalis) soil of colloid material for detailed examination with respect to its content of aluminum, iron oxide, lime, organic matter, and exchangeable calcium, and its hydrogen ion content as indicated by the pH value. Similar examination was made also of each horizon of each of the other soils "for comparison of physical properties with chemical composition."

All of the soils showed a behavior more similar to that of the plastic or nonfriable group than to the friable or lateritic group, though there was observed "some slight lateritic tendency in the Aiken and Olympic series."

Both the separated colloids and the complete soils are described as having shown a high retentive capacity for soluble phosphates, this property having been found more marked in the colloid fraction, however, than in the entire soil. The exchangeable calcium and other exchangeable bases taken together were found not adequate to account for the entire phosphate retention either of the whole soil or of the colloid fractions.

The vertical distribution of soil bases and acidity in some Illinois soils, H. A. LUNT (*Soil Sci.*, 28 (1929), No. 2, pp. 137-176, figs. 17).—Soils from treated and untreated plats on eight Illinois experiment fields, each of a different soil type, were sampled by means of borings, of which 18 were composited to form each sample. The samples were taken by 3- to 4-in. strata into the C horizon where this feature of the profile occurred within from 25 to 30 in. from the surface. Determinations were made of the H-ion concentration, of the Comber thiocyanate test value, of the buffer action, of the lime requirement as indicated by the Hutchinson-MacLennan and the Hopkins methods, and of the total exchangeable calcium and magnesium contents.

The pH values were found in all cases to increase with the depth, with the greatest increase in the case of the Joliet soil overlying a highly calcareous subsoil. The Comber test was found to agree closely with the pH values.

The Hutchinson-MacLennan lime requirement data compared "favorably" with the results of electrometric titrations to a pH value of approximately 7.0 with calcium hydroxide. The pH values varied in general with the total calcium content, except in the case of a black clay loam taken at Hartsburg. "This soil being a comparatively immature one, its calcium has not been leached out of the surface to the extent that it has in the older soils."

A number of other observations, general and locally specific, are also recorded.

The utilization of moisture on heavy soils of the southern Great Plains
H. H. FINNELL (*Oklahoma Sta. Bul. 190 (1929), pp. 24*).—From among a large variety of observations on Amarillo silty clay loam during the crop season 1924-1927 and conclusions recorded the following may be cited:

From 22 to 39 per cent of the total rainfall of a wet period might go into the subsoil, and in the heavy type of plains soil investigated about 20 per cent of the annual rainfall became subsoil moisture. Showers in which the precipitation amounted to 0.5 in. or less did not increase the soil moisture unless these light rains fell during consecutive days; and rains exceeding 1 in. occasioned some run-off unless they fell very slowly or were held on the field by contour tillage or by level terraces. Run-off from heavy soils of "minimum slope" was estimated at 13.5 per cent of the total rainfall.

About 20.7 per cent of the total rainfall was found to become soil moisture. Of this, some 2.7 per cent was lost in the evaporation occasioned by ordinary tillage operations, leaving 18 per cent available to plants. About 65.8 per cent of the total rainfall was found to evaporate from the surface either during the precipitation or immediately thereafter; and out of the portion so lost 31.3 per cent is considered to have been contributed by showers individually too light to add anything to the "permanent store" of soil moisture. The fractions of the rainfall which were found so light or so heavy as to add nothing to the soil moisture did, none the less, aid materially in crop growth.

Under the conditions of the cropping experiments, the average growing season having been 114 days, an average of 0.91 in. of water in addition to the current rainfall was taken from the soil by the crop. With respect to crop yield, the initial soil moisture content was found to have an effect approximately equal to that of the quantity of the current rainfall.

Only such cultural conditions as remove moisture very rapidly, deep plowing, for example, or plant growth, were found to threaten the immediate loss of a body of stored moisture. The temperature appeared to have an effect relatively unimportant with respect to the quantity of moisture stored or to the rate of gain of moisture in the soil, but was highly significant in modifying the relationships of rainfall, wind, and humidity to the behavior of soil moisture.

The chemical composition of Florida Everglades peat soils, with special reference to their inorganic constituents, H. E. HAMMAR (*Soil Sci., 28 (1929), No. 1, pp. 1-13, pl. 1, fig. 1*).—Peat and muck soils of three groups designated, according to their native vegetation, as saw grass, elderberry, and custard apple soils, were sampled, for the analysis of Everglades soils here reported from the Florida Experimental Station, at eight representative points in each group and to a depth of 5 ft. Silica, nitrogen, lime, magnesia, iron as oxide, phosphoric anhydride, potash, and alumina were determined in the surface foot only, as were also the specific gravities. At the lower levels ash and acidity determinations only were made. From these data various conclusions as to the composition of the soils concerned are drawn.

The soils under custard apple vegetation and those under saw grass cover showed themselves chemically distinct, the first named being a muck soil, of sedimentary character, whereas the saw grass soil proved to be true peat, of accumulative origin. The material designated elderberry soil proved to be a less definite classification, including areas nearly identical with each of the two definite forms and also intermediate gradations. The custard apple muck soil contained apparently but little fiber, the elderberry and saw grass material relatively much larger proportions.

[*Soil Survey Reports, 1924 Series*] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1924, Nos. [23], pp. 48, fig. 1, map 1; 29, pp. 80, pls. 4, figs. 2, maps 2).*—Two surveys are here noted.

No. [23]. *Soil survey of Lac Qui Parle County, Minnesota*, J. A. Elwell et al.—Lac Qui Parle County, southwestern Minnesota, contains 496,640 acres of generally undulating to moderately rolling lands, of which the natural drainage system, in itself not entirely adequate, is so far supplemented by a total of from 225 to 250 miles of artificial drainage that "only about 20 or 25 square miles are in ordinary seasons of rainfall too wet for cultivation."

Barnes loam, 57.4 per cent of the total area, is the most important of the 18 types of 8 series here mapped and described, Webster silty clay loam following with 13.1 per cent. This survey was conducted in cooperation with the Minnesota Experiment Station.

No. 29. *Soil survey of Cass County, North Dakota*, E. W. Knobel, M. F. Peightal, and J. E. Chapman (pp. 1-52).—This survey, conducted in cooperation with the North Dakota Experiment Station, was concerned with the soils of the area of 1,140,480 acres occupied by Cass County, southeastern North Dakota, of which area the western portion, of an undulating to very gently rolling surface, is better drained than is the smooth plain, once included in the bed of Lake Agassiz, which constitutes the eastern part of the county. Drainage for the county as a whole is provided mainly by the Red, Sheyenne, Maple, and Wild Rice Rivers, supplemented by about 175 miles of drainage ditches communicating with these streams. "The higher banks . . . and the higher lake terraces are very well drained and constitute the most highly prized farming land in the valley."

The soil types of outstanding areal importance in Cass County are indicated as Fargo clay 24.3 per cent, Barnes loam 22.5, and Fargo silty clay 11.2 per cent of the total area. The entire number of types found amounted to 25, here classified as 8 series.

II. *The chemical composition of the soils of Cass County*, T. H. Hopper and H. L. Walster (pp. 53-80).—This part describes the analyses of samples from 74 fields representing 99.9 per cent of the area and including 26 out of the 30 types and phases.

Separate series of figures are given for the surface soil (7 in.), the sub-surface soil (7 to 20 in.), and the subsoil (20 to 40 in.). The components determined were the total contents of nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, and silicon, together with carbon in the organic and in the carbonate forms. Certain ratios and equivalents calculated from these primary data are also tabulated.

Soils of the Punjab, P. E. LANDER, R. NARAIN, and M. MOKAND LAL (*India Dept. Agr. Mem., Chem. Ser., 10 (1929), No. 2, pp. [3]+25-142, pls. 11).*—Though this report is not a soil survey, the first section takes up the physical, geological and meteorological factors affecting the soil conditions of the Punjab, together with the subjects of irrigation, underground water, and "agricultural features and general soil conditions." Section 2 deals specifically with the Himalayan

tract, section 3 with the sub-montane tract, section 4 with the Indo-Gangetic plain, section 5 with the northwest dry area, section 6 with mechanical analyses, and section 7 with chemical analyses including nitrogen, organic matter, lime, the lime-magnesia ratio, potash, phosphoric acid, iron and aluminum, the aluminum-clay ratio, and the ratio silica:alumina:bases. Section 8 deals with some of the important crops of the Punjab; section 9 with subsoils; section 10 with the barren lands (alkali, bara, and bari soils); and section 11 with some virgin lands of the Province. Section 12 consists of appendix A—a method for the mechanical analysis of soils, and appendix B—the mechanical analysis of soils, to which are added 17 tables of analytical results (pp. 64-142).

The two special varieties of barren lands are described as follows: (1) Bara is an alkali soil possessing the distinguishing characteristics of extreme aridity and density of texture, and is "most intractable." (2) Bari is described as "a lighter type of bara." The bara soil was found to contain shells and is considered probably to have been deposited under water.

Composition of natural organic materials and their decomposition in the soil.—IV, The nature and rapidity of decomposition of the various organic complexes in different plant materials, under aerobic conditions, F. G. TENNEY and S. A. WAKSMAN (*Soil Sci.*, 28 (1929), No. 1, pp. 55-84, figs. 8).—The decomposition in the soil of cornstalks, rye straw, oak leaves, and alfalfa was dealt with in a manner similar to that in the experiments reported in the preceding paper (*E. S. R.*, 59, p. 719) of this series of communications from the New Jersey Experiment Stations, and by means principally of the special methods already noted in some detail from the first paper of the series (*E. S. R.*, 58, p. 508).

The general observations and conclusions recorded for the most part repeat and confirm those previously reported. In the case of plant materials having a relatively low nitrogen content (from 0.2 to 1.7 per cent), decomposition in the soil was found to be accompanied by an increase, both relative and absolute, in the crude protein content, a result which is attributed to synthetic activities of microorganisms concerned in the decomposition of celluloses and hemicelluloses. Though the lignins appeared, as in the previous work, to be more resistant than were other components of the material investigated, it was found that "under aerobic conditions . . . there is a decided reduction in the total lignin content, indicating that, although it is attacked less readily than the celluloses and proteins, its resistance to decomposition is only relative."

Of the materials taken up in the present paper, cornstalks were the most readily decomposed, yielding, after from 12 to 14 months at optimum temperature and moisture and under aerobic conditions, a residue possessing "all the properties of soil organic matter or soil 'humus.'"

The fermentation of glucose and xylose by the nodule bacteria from alfalfa, clover, pea, and soybean. M. FOOTE, W. H. PETERSON, and E. B. FRED (*Soil Sci.*, 28 (1929), No. 3, pp. 249-256, figs. 8).—When cultures of *Rhizobium meliloti*, *R. trifolii*, *R. leguminosarum*, and *R. japonicum* were grown at the Wisconsin Experiment Station in a sugar medium with either calcium carbonate or basic slag present, approximately three-fourths of the sugar was destroyed in the course of 75 days' growth of the cultures, whereas in the absence of the basic substances only one-half of the sugar was destroyed in the same period. The rate of fermentation of glucose and xylose was usually faster in the young cultures and showed a gradual decrease with increase in age. As a rule, the maximum number of bacteria was found to have been reached with 10 days, although in some cases there were several successive decreases and increases in bacterial numbers.

Variations in the calcium and magnesium contents of pea plants on different soil types, J. F. FONDER (*Soil Sci.*, 28 (1929), No. 1, pp. 15-26).—Growing pea plants were found greatly to reduce the quantities of calcium and magnesium in the various soil solutions, but at the same time showed a tendency to reduce the acidity of strongly acid soils as well as to increase that of alkaline or nearly neutral soils.

The use of varying soil types induced wide variations in the calcium and magnesium contents of the plants, the quantity of calcium found in the plant varying, in the case of soils similar in texture and reaction, directly with the quantity available in the soil solution. Both soil texture and soil reaction, however, proved capable of influencing the calcium content of the plants; and to such an extent as to obscure the effect of the calcium concentration of the soil solution, if allowance were not made for the interfering factor.

Both the calcium and magnesium contents appeared to be higher in the slowly growing than in the rapidly growing plants. The magnesium content of the plants was found highly variable, and "appeared to be influenced more by soil texture than any other characteristic of the soils studied."

Some influences of the development of higher plants upon the microorganisms in the soil.—III, Influence of the stage of plant growth upon some activities of the organisms, R. L. STARKEY (*Soil Sci.*, 27 (1929), No. 6, pp. 433-444, figs. 3).—Having indicated in the earlier reports (E. S. R., 61, p. 500) of this series the general nature of the marked effect observed to be exerted upon the members of the soil population by the development of higher plants, the author proceeds in the present communication from the New Jersey Experiment Stations to the discussion of the results of experiments on the influence of higher plants upon the rate of decomposition of soil organic matter as measured by the evolution of carbon dioxide from the soil and upon the reactions concerned with the formation of nitrates in the soil.

Measurements of the quantities of carbon dioxide produced by the soil microorganisms and of the rate of nitrification of ammonium sulfate, and determinations of the quantities of nitrate nitrogen produced from the soil organic matter, made periodically throughout the development of the plants grown both in the greenhouse and in the field, indicated, among others, the effects noted below.

Plant growth was attended by an increased carbon dioxide evolution, of which the course was distinct for each plant and was related to its growth characteristics. The plants exerted in general slight effects during early stages in the growth of the plant, maximum effects at advanced development and fruiting, and less marked effects subsequent to degeneration and death. "Because of their more prolonged development, biennials raised the level of carbon dioxide production over longer periods of time than did the annuals;" and in unplanted soil carbon dioxide production decreased with the advance of the season.

"Nitrification of the soil nitrogen was affected in somewhat the same manner as was evolution of carbon dioxide. Nitrates accumulated more rapidly in soils which supported growth of plants, and the enhanced effects of plants were apparent during advanced stages of growth. Nitrification of ammonium sulfate in the soils did not appear to be affected by plant development to so great an extent as nitrification of the soil nitrogen. During the early stages of the transformation, ammonia disappeared more rapidly in the soils which supported plant growth but the differences became obscured during extended periods of incubation. . . .

"The acceleration in evolution of carbon dioxide and nitrification of the soil nitrogen is believed to be the result of the addition of organic substances to the soil by the growing plants. It seems likely that these organic materials have relatively narrow carbon-nitrogen ratios. Transformation of these plant materials may be responsible for increasing the activity of the nitrifying flora."

Behavior of bacteria in certain soils of low productivity (*New York State Sta. Rpt. 1929, pp. 33, 34*).—The isolation of the organisms to which reference is here made has been noted, together with certain of their characteristics (*E. S. R., 60, p. 420*).

It has now further been shown that the soil in which these organisms were found to make little or no growth (Volusia silt loam), although distinctly acid and of poor crop-producing quality, is "very high in nitrogen and in organic matter" and contains carbon adequate for the growth of the bacteria in question. The nitrogen content of this soil was found to be not readily available to the organisms. It was shown to be possible to correct this condition in the laboratory, although the reasons for the unavailability of the nitrogen under natural conditions and the nature of the changes whereby it is made available have not as yet been determined.

"This point is regarded as important because the bacteria under investigation are not unlike green plants in their nitrogen requirements, and it is thought that any treatment of this soil making the nitrogen available to them will make it also available to crops." The advantages, for such a study, of the relatively brief growth period of bacteria as compared with that of higher plants are pointed out, together with the possible practical significance of such work in connection with the problems presented by certain soils of low productivity.

Nitrates in soil and plant as indexes of the nitrogen needs of a growing crop, B. E. GILBERT and J. B. SMITH (*Soil Sci., 27 (1929), No. 6, pp. 459-468, figs. 3*).—This is a contribution from the Rhode Island Experiment Station, continuing the work reported by Gilbert and Hardin (*E. S. R., 57, p. 812*) on the mineral nutrient content of the plant solution as an index of fertilizer requirements and by Smith (*E. S. R., 60, p. 119*), who has indicated the soil nitrate levels desirable for certain of the market garden crops. The present paper comprises the findings of an investigation of the limits within which soil nitrate concentrations may practically be controlled, and of a comparison of the values of determinations of the nitrate content of the soil with that of like determinations upon the plant, in respect to the prediction of the future nitrogen need of the crop. Growth curves based on photographic measurements, total fertilizer treatment and corresponding yields, and average curves indicating the fluctuations of nitrate concentration in the soil and in the plant for each of a number of crops are among the experimental data presented.

The maintenance of the nitrate concentrations both in the plant and in the soil solution above the values indicated in the station's previous contribution, above noted, as the minimum for optimum yields, was secured by means of side dressings of the soluble nitrogen compounds. Where this was done the yields were uniformly greater than were those obtained with lesser nitrogen applications.

The impracticability of the control of nitrate concentrations within narrow limits was demonstrated. It was also shown that both of the chemical methods given trial as indicators of fertilizer need should be used concurrently, since "the determination of soil nitrates predicts the nitrogen needs of young plants adequately, but plant solution analyses are more exact for later growth stages."

The use of dyes in the isolation of a nitrite-oxidizing organism, C. C. PROUTY (*Soil Sci.*, 28 (1929), No. 2, pp. 125-136).—The bacteriostatic powers, with respect to the two forms found to offer the most serious trouble as contaminants of cultures of the nitrite-oxidizing organism, of dyes of the triphenylmethane, xanthene, quinone-imide, and azo groups were subjected to a general survey in the experiments reported in this contribution from the Idaho Experiment Station, and a further study was then made on a similar group of the more promising compounds.

The best results were obtained with rosaniline hydrochloride. "The two most objectionable contaminating forms can be eliminated by exposing crude cultures of the nitrite-oxidizing organism to the action of this dye in 1 per cent concentrations for from 5 to 30 minutes. The other contaminating form," the development of which could not be prevented by the use of the dye in the manner indicated, "can be eliminated by the use of mechanically operated sterile minute glass pipettes in fishing colonies from the surface of a solid medium."

The contaminating form insensitive to rosaniline was found capable of rapid growth in nitrite medium, but made only a very scanty growth on a nutrient agar medium and had no oxidizing effect either upon ammonia or upon nitrites. "This organism stains well with cold carbol fuchsin, and when stained by this dye many of the cells appeared to possess a flagellum-like attachment at one pole which in many instances was several times as long as the body of the cell. In some preparations the organisms were clustered together with the flagellum-like attachments radiating away from the center of the cluster of bacteria. In many instances the cells were unevenly stained and somewhat pointed at the ends. This organism forms a colony which can be differentiated from the colony formed by the nitrite-oxidizing organism by its characteristic appearance and unevenness of edge."

The nitrite-oxidizing organism, on the other hand, appeared singly, in pairs, and in irregular clusters, stained evenly, and varied in shape from oval to spherical, presenting some difficulty, therefore, as to its morphological classification, either as a coccus or rod form.

A detailed study of the morphological, physiological, and cultural characteristics of the two pigment-forming contaminants capable of rapid growth on ordinary media and eliminable from cultures of the nitrite-oxidizing organism by the ro-aniline treatment is also described.

Denitrification in uncultivated soils, A. KARLSEN (*Bergens Mus. Årbok, Naturv. Rekke*, 1927, No. 2, Art. 4, pp. 140).—From the results of an examination for denitrifying organisms of a total of 113 soil samples, representing cultivated lands, deciduous forest, spruce forest, pine forest, juniper thicket, grass and ling heath, low moors, and high moors, the author concludes that denitrifying bacteria are generally abundant in all such plant communities as were examined. No distinct parallelism could be demonstrated, however, by means of the methods used as between the intensity of the denitrification effect and the nature of the plant community or of the geological substratum.

The probability is pointed out also that "under the extreme climatic and soil conditions of western Norway denitrification may play an important part in the soil."

Results of some pot experiments on the effect of bone meal [trans. title], E. TEUNINGER and F. KELLER (*Landw. Jahrb. Schweiz*, 43 (1929), No. 7, pp. 931-945).—The experiments indicated that bone meals are effective only upon phosphorus-poor, acid soils, and that upon neutral or alkaline soils well sup-

plied with lime no results are to be expected. In no case did a supplementary treatment with gypsum have any noticeably favorable effect upon the action of the bone meal.

When the bone meal was applied in the raw state, after removal of the fat, and after glue extraction, that from which the fat had been removed had the greatest effectiveness. The crude product had the least fertilizer value, about one-third the crop-increasing effectiveness of superphosphate.

The degree of fineness of grinding was found also to have an important bearing upon the effectiveness of the fertilizer.

Is sulfur a limiting factor of crop production in some Utah soils? J. E. GREAVES and W. GARDNER (*Soil Sci.*, 27 (1929), No. 6, pp. 445-457, figs. 4).—The investigations here reported from the Utah Experiment Station comprised determinations of the sulfur content of a limited area of the Cache Valley soils and of the quantities of sulfur taken from these soils by growing crops: a study of the quantities of sulfur brought to the soil by rainwater and irrigation waters; and experiments upon the influence of sulfur compounds (sulphates) upon the bacterial activity of the soil and upon the yield of barley. Also, "on the basis of certain simplifying assumptions," the author developed "a mathematical equation . . . indicating the general form of the relationship between the crop yield and the time," for the case in which no sulfur is added from outside sources. The exception arrived at contains an unintegrated term as an exponent, but it is stated that "on the basis of this equation and by means of the law of diminishing returns, a method of determining the critical sulfur content in terms of soil and crop characteristics and economic constants is illustrated."

From the data and reasoning presented, the conclusion is drawn that "sulfur may become a limiting factor of crop production in some Cache Valley soils. The time required for this to manifest itself in diminished crop returns will vary with the soil, the specific irrigation water used, and the crop grown upon the soil."

Report on inspection of commercial fertilizers for 1929, E. M. BAILEY ET AL. (*Connecticut State Sta. Bul.* 308 (1929), pp. 106+XI).—In addition to the tabular data from the large volume of control analytical work completed during the year reported upon, this bulletin contains brief statements showing the cost, in the form of each of the more commonly used sources, of 1 lb. of nitrogen, of phosphoric acid, and of potash, respectively.

The definitions and standards of fertilizer materials as adopted by the Association of Official Agricultural Chemists are also given, in so far as they have been completed and made official or approved as tentative.

AGRICULTURAL BOTANY

Review of physiological and pathological studies on the pineapple plant, C. P. SIDERIS (*Hawaii. Pineapple Cannery Sta. Bul.* 8 (1926), pp. 10).—On a basis of plant matter produced, a pH of 5.0 was the most beneficial to the pineapple. The protoplasmic proteins were found extremely susceptible to pH values between 6.5 and 8.0, the isoelectric point being pH 6.5. Experiments in soil cultures also testified to the injury resulting from high pH values.

Finding that the concentration of aluminum ions in soils never approached the point of toxicity determined in the laboratory, namely, 35 parts per million, the author concludes that the stunting of pineapple plants sometimes ascribed to aluminum is due to deficiencies of essential ions.

About 30 species of *Fusarium* were isolated from diseased pineapple roots, and the inoculation of healthy roots with a pure culture of one species resulted in the death of those roots when grown in cultures of pH 6.5, 7.0, and 7.5. When placed in cultures of pH 4.0 and 5.0 the injured plants recovered and showed no further advance of the disease, indicating the importance of the soil reaction in the control of *Fusarium*.

A study of three types of soils suggested that loose soils suffer badly from leaching, which removes the salts and thereby the plant foods, and increases the soil acidity.

A close structural relation established between groups of leaves and roots suggested that the vigor of the aerial parts may affect the longevity of the roots. The suckers which form the ratoon plant must depend upon the roots of the parent plant or upon the formation of new roots of their own. Injury to the parental roots and the inability to develop a root system of their own may thus cause the collapse of the ratoons.

Effects of aluminum salts on pineapple plants in water culture, C. P. SIDERIS (*Hawaii. Pineapple Can. Res. Sta. Bul. 3* (1925), pp. 8).—Observations upon the growth of pineapple plants in culture solutions of known pH value and known concentrations of aluminum, potassium, and phosphate ions showed that aluminum is not as toxic as commonly believed, the plants enduring concentrations as high as 25 parts per million without injury. Above this point the amount of injury was directly related to general nutritional conditions. The author points out that aluminum toxicity as indicated in water cultures does not apply equally well to soil cultures, since aluminum is but slightly soluble in soils at pH 4.0 to 5.0 and scarcely at all between pH 5.0 and neutrality. When soluble aluminum salts are added to samples of soil the greater part of the aluminum is removed from the solution.

Osmotic pressure and pH measurements on cell sap of *Pinus ponderosa*, F. W. GAIL and W. H. CONE (*Bot. Gaz.*, 88 (1929), No. 4, pp. 437-441, figs. 2).—Following an earlier paper on the seasonal changes in the osmotic pressure of expressed cell sap of certain plants (*E. S. R.*, 57, p. 619), measurements were made in the present study of the osmotic pressure and pH values of cell sap expressed from first-, third-, and fifth-year needles of *P. ponderosa*, gathered throughout the year with a view to establishing whether there is any relation between osmotic pressure and pH values. A high pH and low osmotic pressure was recorded during the period of growth, and a lower pH and higher osmotic pressure during dormancy. Both pH and osmotic pressure increased with the age of the needles, with fluctuations between the two becoming less with advancing age. Just prior to abscission the pH value of the fifth-year needles was approximately 4.1, about the maximum value observed in the study.

Propagation and food translocation in the common milkweed, F. GERHARDT (*Jour. Agr. Research [U. S.]*, 39 (1929), No. 11, pp. 837-851, figs. 5).—A further contribution to studies at the Iowa Experiment Station upon the milkweed as a source of rubber and other products (*E. S. R.*, 61, p. 338).

Untreated seed was relatively low in germination, even after winter storage, but responded favorably to scarification of the seed coat. An extended period of afterripening was requisite to germination. Self-pollination resulted in no seed. That milkweed roots also undergo rest was indicated in observations on roots lifted at various dates and brought into a greenhouse.

Chemical analyses of the various parts of plants gathered at intervals throughout the season indicated that sucrose is stored in the leaves, transferred in the form of hexoses to the roots where it is stored as starch during the late

summer, and reconverted into sugar at the beginning of winter. No starch was found in the green portions of the plants. Leaf, stem, and roots yielded nitrogenous and carbohydrate materials to the flower and seeds. Ash and rubber were present in the leaf, pentosans and hemicelluloses in the stem, and starch and nitrogen in the roots. The content of rubber in the latex was about 3.5 per cent and was largely localized in the leaf. Freezing destroyed more than 80 per cent of the rubber.

Milkweed latex contains only one-eighth of the rubber found in the Hevea tree and nearly 20 times as much resin. Since hexoses were the only simple sugars present in milkweed latex, it is believed that the lactiferous structures may aid in the translocation of sugars from the leaf to the roots.

GENETICS

Some physicochemical aspects of life, mutation, and evolution, J. ALEXANDER and C. B. BRIDGES (*Science*, 70 (1929), No. 1821, pp. 508-510, figs. 2).—The action of genes is likened to the catalytic action of an alum crystal added to solutions of alum. It is suggested that life began in the molecular order of complexity with an autocatalytic molecule of definite structure and less definite constituents.

Correlation studies with inbred and crossbred strains of maize, M. T. JENKINS (*Jour. Agr. Research [U. S.]*, 39 (1929), No. 9, pp. 677-721, figs. 3).—A corn improvement investigation by the U. S. D. A. Bureau of Plant Industry, cooperating with the Iowa Experiment Station, was undertaken primarily to determine characters associated with productivity in the hope that these characters might then be used as indexes for selection. The material and field technic are described, and correlation coefficients are reported among characters within the same generation in inbred lines of corn and in F_1 crosses between inbred lines, between characters in the inbred parent lines and the same characters in the crossbred progeny, and between characters of the inbred parent lines and the yield of the crossbred progeny.

Within the inbred lines yield was correlated significantly and positively with plant height, number of ears per plant, ear length, ear diameter, and shelling percentage. Yield also was correlated significantly and negatively with date of silking, shrinkage of the harvested ears, chlorophyll grade, and ear-shape index. Within the F_1 crosses yield was correlated significantly and positively with date of tasseling, date of silking, plant height, number of nodes per plant, number of nodes below ear, number of ears per plant, ear length, ear diameter, and shelling percentage, and it was correlated significantly and negatively with percentage of plants smutted, percentage of ears moldy, and ear-shape index.

Between characters in the inbred parents and the same characters in the crossbred progeny positive correlations were obtained for all of the 19 different characters studied. Correlations between characters of the inbred parent and the mean values of the same characters in the crossbred progeny were often high enough to be of value in prediction. Yield of the F_1 cross was correlated significantly and positively with certain characters in the parents, including date of tasseling, date of silking, plant height, number of nodes per plant, number of nodes below ear, number of ears per plant, ear length, ear diameter, and yield, and was correlated significantly and negatively with ear-shape index in the parents.

The mean yield of the crossbred progeny was correlated significantly and positively with plant height, number of nodes per plant, number of nodes below ear, and yield of the inbred parent line.

In different inbred lines marked differences were observed in prepotency for practically all of the characters studied. The high-yielding crosses did not appear to have been chance combinations but occurred very definitely among the crosses by certain outstanding parent lines. The extreme productivity of the crosses of some of the inbred lines seemed promising and indicative of results from the program of corn breeding.

"Kindzu" or "Golden Bean" orange (*Fortunella hindsii*) from historic, taxonomic, and cytologic standpoints, W. T. SWINGLE (In *Proceedings of 3. Pan-Pacific Science Congress, Tokyo, 1926*. [Tokyo: Natl. Research Council of Japan], 1928, vol. 2, p. 2001).—An abstract is given of a paper on the botany and history of *F. hindsii*, a citrus species, which the author states was found by A. E. Longley to be tetraploid. A seedling of *F. hindsii* and the Eustis limequat (*F. japonica* × *Citrus aurantifolia*) was found to be of triploid nature.

Dahlia sports and their fixation [trans. title], H. and [L.] CAYEUX (*Bul. Mens. Soc. Natl. Hort. France*, 5. ser., 2 (1929), Oct., pp. 546-549, fig. 1).—Discussing the origin of new varieties of flowers by color mutation, the authors suggest two methods of propagation for perpetuating bud mutations in the dahlia. In one case cuttings of the mutant shoot were taken in August and potted. Instead of vegetative growth the cuttings developed tubers at the base. In the second plan all shoots except the mutant one are removed, later moving the plant to the greenhouse where it is held as a source of spring cuttings.

The variation of domestic animals in the light of genetics [trans title], C. WRIEDT (*Ztschr. Tierzücht. u. Züchtungsbiol.*, 14 (1929), No. 3. pp. 399-413, figs. 8).—The author has selected numerous examples of variations in horses, asses, cattle, sheep, goats, and dogs from different parts of the world, and shows that where the peculiar characteristics result from unfavorable environment the animals respond when placed under more favorable conditions. On the other hand, when genetic factors are responsible the peculiar characteristics persist. Cases of extreme variation between closely related animals, resulting from the segregation of factors, are also noted.

The inheritance of Rhode Island Red chick down-color variations and their relation to color variations in adult plumage, D. C. WARREN (*Jour. Agr. Research* [U. S.], 39 (1929), No. 10, pp. 781-794, pls. 2, figs. 3).—As previously noted (E. S. R., 61, p. 123) it was possible to establish strains of Rhode Island Reds at the Kansas Experiment Station which bred relatively true for dark and light red down color. A single factor difference with the absence of dominance appeared to account for most of the variation.

The grade of down color was correlated with the grade of adult color characteristics as follows: Adult surface color in males 0.179 ± 0.020 , adult plumage color in females 0.229 ± 0.016 , adult breast color in females 0.238 ± 0.015 , adult under color in males 0.478 ± 0.008 , adult under color in females 0.517 ± 0.006 , black in adult wing feathers in females 0.133 ± 0.020 , black in adult wing feathers in males 0.162 ± 0.028 , and adult eye color in both sexes -0.123 ± 0.015 . The association of the grade of chick down color with the presence or absence of excess black in females and the presence or absence of smut in males and females and white in the under color of males was tested by the χ^2 test. The respective probabilities for similar distributions in the down grades of the presence and absence groups were, respectively, 0.029, 0.000000, 0.000000, and 0.000000. It was thus concluded that black in the adult surface color was not related to down color, whereas smut and white in the under color were associated with the grade of down color.

Chicks showing conspicuous striping at hatching are likely to develop into adults with under color of inferior quality, usually carrying considerable smut and white.

It was further evident that chicks having the lightest shades of down might develop into very dark adults, but dark chicks seldom produced the adults with the lighter shades of red.

Parthenogenesis and the inheritance of color patterns in the grouse locust *Paratettix texanus* Hancock. R. K. NABOURS and M. E. FOSTER (*Biol. Bul. Mar. Biol. Lab., Woods Hole*, 56 (1929), No. 2, pp. 129-155).—From a study of parthenogenesis in the grouse locust at the Kansas Experiment Station, evidence was presented to indicate that a genetic factor or a group of complementary factors is responsible for parthenogenesis.

In the species *P. texanus* fertilized eggs produce males and females in equal numbers, but unfertilized eggs, with rare exceptions, produce only females. Mated females may have part of their ova fertilized and produce other offspring parthenogenetically. Fertilized eggs proceed with the second polocyte division and develop bisexually, while in parthenogenesis the last polocyte division does not occur, or if it does the polar body is not eliminated. With the presence of the specific complementary gene or genes responsible for parthenogenesis, diploidy is retained or restored and development may begin immediately. This method of reproduction permits the segregation of factors as in bisexual reproduction. Progeny from unfertilized eggs are usually homozygous for all factors which they carry, though occasionally they prove to be heterozygous for certain factors.

Genetical and cytological proof of translocations involving the third and the fourth chromosomes of *Drosophila melanogaster*. T. DOBZHANSKY (*Biol. Zentbl.*, 49 (1929), No. 7, pp. 408-419, figs. 6).—Males heterozygous for short bristles, a second-chromosome dominant gene, and dichaete, a third-chromosome dominant gene, were X-rayed and subsequently mated with untreated females having attached X chromosomes homozygous for the sex-linked recessive gene yellow and the recessive fourth-chromosome gene cycless.

In the 153 cultures of this type 5 gave no recombinations of dichaete and cycless, while 4 gave no recombinations of short bristles and dichaete. Breeding tests of the offspring indicated that the lack of these types was due to translocation of a piece of the third chromosome and its attachment to one of the fourth chromosomes. The translocation decreased the frequency of the crossing over in the half of the third chromosome in which the breakage occurred and slightly increased the crossing over in the opposite half of the chromosome. Cytological study confirmed the genetic evidence regarding the translocation.

The study further indicated that the larger pair of the V-shaped autosomes carried the third-chromosome group of genes and the smaller pair the second-chromosome linkage group.

Segregation of skull form of Pekingese dogs [trans. title], C. WRIEDT (*Züchter*, 1 (1929), No. 7, pp. 203, 204, figs. 4).—The author reports the preliminary results of experiments in crossing dogs having long skulls and noses with Pekingese dogs having short noses and round skulls. The results indicated that a single Mendelian factor is responsible for the Pekingese type of skull.

The diagnosis of the type of twinning, I, II. H. S. REICHEL (*Biol. Bul. Mar. Biol. Lab., Woods Hole*, 56 (1929), Nos. 3, pp. 164-176; 5, pp. 313-326).—In part 1, dermatoglyphics, the author presents evidence based on the finger and sole prints of double monsters and 40 pairs of nonconjoined twins to

indicate that dermatoglyphics is not a reliable method of determining whether twins are monozygotic or dizygotic. In part 2, clinical aspects, a comparison of the characteristics of 38 pairs of twins with clinical observation on the condition of the membranes indicates that present methods for diagnosing the type of twinning are either impracticable or unreliable when applied to children and infants. The description of the birth membranes showing the condition of the septum furnishes the most reliable evidence of the type of twinning.

On the biology of the albino rat in parabiotic union.—Report I, The oestrous cycle, S. MATSUBA (*Jour. Col. Agr., Imp. Univ. Tokyo*, 10 (1929), No. 3, pp. 229-233, pls. 2).—In studies of the effect of parabiosis on the oestrous cycle it was found that in cases where a female was united parabiotically with a mature male some unknown substance, probably the testicular hormone, suppressed the oestrous cycle in the female. A similar suppression was observed in one female when two females were united.

When a female rat was united with a gonadectomized male or female a marked irregularity in the oestrous cycle followed. This was especially pronounced in the continuance of the fifth or cornified stage.

Effects of ovariectomy upon menstruation in monkeys, E. ALLEN (*Amer. Jour. Physiol.*, 85 (1928), No. 3, pp. 471-475).—Studies of the influence of the removal of the ovaries on the menstrual cycle in monkeys indicated that the ovarian hormone secreted by the follicles, the corpus luteum, or the atresic follicles induced growth in the genital organs, while menstruation resulted from decreased amounts or absence of the ovarian hormone after a certain amount of growth and development of the endometrium had been induced.

The effects of bilateral ovariectomy in the Brown Leghorn fowl, L. V. DOMM (*Biol. Bul. Mar. Biol. Lab., Woods Hole*, 56 (1929), No. 6, pp. 459-496, pls. 2).—From a study of 19 Brown Leghorn females from which the ovaries were removed at 76 to 79 days of age and 16 to 22 days later the rudimentary ovary was removed, the author found that complete bilateral ovariectomy led to an asexual or neutral type of fowl common in many of its characteristics to both sexes. The head furnishings remained small, and the plumage was of the male type. Well-developed spurs were also present, but the sex behavior of the individuals was neutral. No hypertrophy of the Wolffian ducts was perceptible as was the case following sinistral ovariectomy. Complete bilateral ovariectomy resulted in a considerable reduction in the oviduct. The body size was approximately normal for hens.

Integumental grafting in the domestic fowl, A. W. KOZELKA (*Jour. Heredity*, 20 (1929), No. 1, pp. 2-14, figs. 10).—The author describes the characteristics of comb, feather, and spur grafts transplanted onto different parts of the body of the same and different fowls. The sex characteristics exhibited in the grafts were those of the donor rather than the host, though the transplantations were made with chicks at an early age. Some evidence of tissue antagonism was noted in certain of the homoiografts.

Further studies on the sex ratio in the chicken, W. V. LAMBERT and V. CURTIS (*Biol. Bul. Mar. Biol. Lab., Woods Hole*, 56 (1929), No. 3, pp. 226-233).—A study of the sex ratio of 2,501 chicks and embryos dying after 14 days of incubation from eggs set during the hatching season (April 11 to July 17, 1928), at the Iowa Experiment Station showed that 46.32 ± 0.67 per cent were males. Variations in the sex ratio of different groups did not appear to be related to the time during the hatching season when the eggs were set, the colony by which the eggs were produced, antecedent egg production, or age of the hen.

The sex ratio of embryos dying in the shell was 47.36 ± 1.29 and of chicks hatched 46.61 ± 0.79 per cent, and no evidence of selective mortality of either sex prior to hatching was observed.

Cinematographs of living developing rabbit-eggs, W. H. LEWIS and P. W. GREGORY (*Science*, 69 (1929), No. 1782, pp. 226-229; *abs. in Anat. Rec.*, 42 (1929), No. 1, p. 27).—The ova of rabbits 21 to 71 hours after mating were mounted in autoplasmia with or without embryonic juice. When kept in a warm box, growth and development continued for as long as 4 days, forming the trophoblast, segmentation cavity, and inner cell mass. In some cases the development was abnormal, as in the cultures the first two blastomeres divided at irregular times, perhaps indicating that in the two-cell stage there are qualitative differences due to the beginning of cell differentiation.

The resistance of the zona pellucida caused a split in the blastocyst in the tissue cultures, indicating that normally the zona pellucida is probably softened or digested by uterine secretions.

Microdissection studies on human spermatozoa, G. L. MOENCH and H. HOLT (*Biol. Bul. Mar. Biol. Lab., Woods Hole*, 56 (1929), No. 4, pp. 267-273, figs. 3).—Microdissection studies of human spermatozoa have indicated that various differences in size and shape of the sperm heads observed in seminal smears are more likely due to conditions than artefacts. For example, double appearing cells were not two separate sperm cells lying together but were adherent, and curvatures in the middle piece represented some inherent disturbance in this region.

Of interest also were the findings regarding the elasticity of the sperm head and the tendency to repair lesions or the formation of globular bodies when portions of the sperm head were broken off.

FIELD CROPS

Experimental error of field trials in Australia, H. C. FORSTER and A. J. VASEY (*Jour. Dept. Agr. Victoria*, 27 (1929), No. 7, pp. 385-395, figs. 4).—Repetition of the wheat experiment of Mercer and Hall (*E. S. R.*, 26, p. 732) at the Werribee, Victoria, State Research Farm revealed the presence of (1) casual errors due to small chance errors in harvesting technic, uneven seeding, fertilizing, and rabbit tracks, and (2) more regular errors due to marked soil variations, climate, etc. The casual error attaching to a single plat appeared to decrease with the increasing size of plat, whereas the more systematic error of soil variation became more important. The optimum size of plat for field trials for cereals under the conditions was found to be $\frac{1}{40}$ -acre. There was evidence to show that a long narrow plat is the more desirable for field trials. The error attaching to a $\frac{1}{40}$ -acre plat seemed to be diminished to a working minimum by a replication of five times in any one series.

Why we believe, S. C. SALMON (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 8, pp. 854-859, fig. 1).—A discussion of the merits and applications of modern statistical methods.

Grassland problems ([*Gt. Brit.*] *Min. Agr. and Fisheries Misc. Pub.* 60 (1928), pp. 87, pl. 1).—Papers given at the Agricultural Organizers' Conference in Cambridge in April, 1927, and summarizing recent information on grassland include *The Nutritive Value of Pastures from the Point of View of the Mineral Content*, by J. B. Orr (pp. 5-13); *The Nutritive Value of Pasture Grass from the Point of View of Energy and Protein*, by H. E. Woodman (pp. 14-32); *Sectional Grazing of Grassland*, by W. Brunton (pp. 33-40); *The Use of Nitrogen in the Manuring of Pastures and Its Application to British Conditions*,

by J. G. Stewart (pp. 41-47); A Short Survey of Grass Land Problems in Some Counties, by J. A. Hanley (pp. 48-55); Permanent and Temporary Grass, by R. G. Stapledon (pp. 56-80); and Grassland Husbandry of the Future, by T. B. Wood (pp. 81-87).

Further studies of Indian grasses and grasslands, W. BURNS, L. B. KULKARNI, and S. R. GODBOLE (*India Dept. Agr. Mem., Bot. Ser., 16 (1928), No. 4, pp. [2]+101-148, pls. 8*).—Further investigations (*E. S. R., 55, p. 229*) were made on the grasslands of the Bombay Presidency from 1925 to 1928, inclusive.

The additional observations confirmed the previous statement that variations in grassland depend on soil moisture. Other outstanding points were the slowness of improvement of grasslands in areas of low rainfall and shallow soil, the marked difference between the same species on deep and shallow soil, and the great increase that could be gained in total weight of grass from any area forced to give its maximum yield by proper methods.

An investigation into West Australian pastures, E. J. UNDERWOOD (*Thesis, Univ. West. Aust., Perth, 1929, pp. 15, fig. 1*).—Analyses of samples of pasture herbage obtained under widely varying conditions in the southwest portion of Western Australia showed that very little difference is apparent between the energy values of good and poor pastures in the State. However, very large differences were observed in the proportions in which protein and phosphorus were present in different pastures. Such differences corresponded closely with the reputed value of the pasture, a low protein and phosphorus content being associated with a low nutritive value and a high protein and phosphorus content with a high nutritive value. Similar although slighter differences were noted also in total ash and in silica-free ash. Lime appeared to be abundant almost everywhere. Applications of superphosphate, however, gave quite large increases of protein and phosphorus in the herbage in the southern districts.

Increasing the protein content of pasture grasses by frequent light applications of nitrogen, C. R. ENLOW and J. M. COLEMAN (*Jour. Amer. Soc. Agron., 21 (1929), No. 8, pp. 845-853, fig. 1*).—On both fertilized and unfertilized areas at the Florida Experiment Station grasses mowed frequently averaged much higher in protein content than when cut only at the end of the growing season. It was observed that the protein content of pasture grass in a grazed condition can be increased and maintained at a somewhat higher level than usual by frequent light applications of a nitrogenous fertilizer, as ammonium sulfate. The pasture grasses used, i. e., Bahia, centipede, and carpet grasses, gave much higher forage yields from the nitrogen applications. The yield appeared to follow the rainfall, and increasingly when nitrogen was supplied. The total nitrogen content was higher in the grass when nitrogen was plentiful in the soil and was also high at periods of low rainfall, due to the small quantity of forage produced.

The relationship of organic root reserves and other factors to the permanency of alfalfa stands, G. JANSSEN (*Jour. Amer. Soc. Agron., 21 (1929), No. 9, pp. 895-911, figs. 9*).—An alfalfa investigation at the Arkansas Experiment Station dealt with the organic root reserves and changes occurring therein in Hairy Peruvian and South Dakota Grimm alfalfa during the winter months, the relationship between these reserves and stand reduction, the relation between varieties and reduction of stand from the viewpoint of the aggressiveness of the plant, and the possible effect of winter injury and subsequent final invasion as related to well-developed plants.

A rapid reduction in alfalfa stand seemed to take place after the second year of cropping to alfalfa on the same land. Varietal differences were noted

in persistence in maintaining good stands. Northern alfalfas had a greater forked-root system and developed a larger crown system and seemed to maintain their stand longer than southern varieties. Reduction of stand evidently may result from direct killing by low temperatures, by freezing to death as a result of fluctuating temperatures, or by partial freezing and subsequent fungal and bacterial invasion of the crown and root system of the plant.

The percentage of dry weight and total dry matter per plant are greater for the winterhardy Grimm than for the nonwinterhardy Hairy Peruvian. A study of the carbohydrate reserves of the roots of these alfalfas indicated that the sugars are nearly always greater during the winter in the Grimm than in Hairy Peruvian, particularly in the middle winter period. The starch and dextrins may vary with the season and plant. The total soluble nitrogen was greater in roots of Grimm alfalfa during the winter months.

The wide changes of temperature over a short time appeared to be more harmful in the section than severe cold weather. Successive warm and cold periods kill top growth of the less hardy varieties and allow for fungal invasions. Winter dormancy seems to be an essential for any variety to be grown successfully in the section.

Maturity influences quality of alfalfa seed, M. S. GRUNDER and C. R. MEECE (*Michigan Sta. Quart. Bul.*, 12 (1929), No. 2, pp. 61, 62).—Determinations on alfalfa seed of the fall crop of 1927 from pods ranging from very immature to dark brown mature and also frozen when immature, plump green, and mature showed seed from dark brown pods to be heavier and to outnumber seed from any other class. Small seed from dark brown pods were heavier and germinated better (about 90 per cent) than small seed from any other class. Evidently seeds reaching slightly less than one-half full weight could be expected to germinate at least 70 per cent, the germination rising as the average weight increases. Brown seeds were of little value except in pods frozen in more advanced maturity. Bright, plump seed frozen in this condition showed a very high germination, the weaker seeds evidently being discolored by freezing. If weather or other conditions make it necessary, the alfalfa seed crop can be cut when the seeds are one-half or more grown, even though most pods are yet green. Seed of fair quality may be obtained by screening out the seeds less than one-half grown and by fanning out the brown seed.

Hardy alfalfas lead Michigan over-State tests, H. C. RATHER and G. F. WENNER (*Michigan Sta. Quart. Bul.*, 12 (1929), No. 2, pp. 53-58, figs. 2).—Co-operative tests with alfalfa varieties in different parts of Michigan have practically duplicated results at the station (*E. S. R.*, 59, p. 34) and have emphasized further the need of hardy types throughout the State. Hardigan and Grimm are the varieties best adapted.

Subterranean clover and winter-killing, R. G. STAPLEDON and M. T. THOMAS (*Jour. Min. Agr. [Gt. Brit.]*, 36 (1929), No. 7, pp. 616-619, pl. 1).—The importance of sowing subterranean clover not earlier than June 15 or 30 was demonstrated again. Practical conclusions drawn from several years' study at the Welsh Plant Breeding Station were that subterranean clover is not suitable for districts normally subject to severe winters, and that in districts with reasonably mild winters the danger of winterkilling in exceptional years can be reduced greatly by selecting sheltered fields on the lighter and well-drained soils and by sowing in a simple mixture and not grazing too hard during very cold periods.

Subterranean clover seed and its impurities, with a comparison between machine cleaned seed and seed in the burr, H. G. ELLIOTT (*Jour. Dept. Agr. West Aust.*, 2. ser., 6 (1929), No. 2, pp. 274-279, figs. 2).—The principal weed

seeds found in seed of subterranean clover are listed. During several years machine-cleaned seed has tested higher in germination and purity and usually contained lower percentages of weed seed. Hard seeds in cleaned seed averaged 30 per cent, ranging from 2 to 70 per cent, and in the bur 71 per cent, ranging from 54 to 91 per cent.

Correlations between seed ear and kernel characters and yield of corn, A. M. BRUNSON and J. G. WILLIER (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 9, pp. 912-922).—Biometrical studies on 900 ears of Pride of Saline corn selected in 1923 and on their triplicated progeny rows of 1924 and 1925 were made at the Kansas Experiment Station in cooperation with the U. S. D. A. Bureau of Plant Industry.

The correlations indicated that smaller seed ears tended to give progeny rows having a higher average number of ears per plant. Relatively smooth indentation and small kernels of the seed ear were associated with prolificacy in the progeny, and smoothly indented, heavy kernels with rounded corners were associated with high survival in the progeny plants. Yield and prolificacy were correlated highly, at least part of the correlation in the ear rows seeming due to the tendency of the inherently prolific strains to be the more productive. Slender seed ears with smoothly indented, heavy kernels tended to produce high yielding progeny rows. The influence of circumference of ear on yield appeared to be due to its association with prolificacy. The influence of weight of kernel seemed to lie largely in the greater survival of plants from large kernels.

Dehiscence of the flax boll, A. C. DILLMAN (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 8, pp. 832, 833, fig. 1).—The author observed that three major types of flax bolls can be distinguished according to the nature of their dehiscence. In the first type, e. g., *Linum usitatissimum crepitans*, the bolls are completely dehiscent, the segments separating widely and scattering the seeds as soon as the boll is ripe. The second type, including practically all varieties grown for seed or fiber in the United States, has bolls which are semidehiscent when the plants are ripe, and in the third type, e. g., most of the Argentine strains, the bolls remain slightly closed when ripe. The fact that in the common varieties of flax the ripe bolls are highly hygroscopic, the bolls opening when they dry out and closing again when wet by dew or rain, may suggest the proper condition of flax for harvesting, particularly with the combine. In flax dry enough to thresh readily with the combine, the bolls are partly open.

Moisture content of flaxseed and its relation to harvesting, storage, and crushing, A. C. DILLMAN and R. H. BLACK (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 8, pp. 818-831, fig. 1).—Recent observations and tests by the authors in Montana, North Dakota, and Minnesota on the moisture relations of flaxseed in growth, maturity, harvest, and storage are reviewed.

The growing young flaxseed contains a high percentage of moisture which gradually declines toward maturity. In the growth of the seed a more or less steady increase in dry weight is coincident with a decrease in moisture content. After the growth of the flaxseed is completed, the ripening process is chiefly a matter of dehydration or drying of the seed. This drying process proceeds very rapidly under favorable climatic conditions. The whole bolls and the chaff of the threshed bolls appeared to be much damper than the seeds, suggesting that the seeds may ripen earlier than the boll and more or less independently of it.

In clean, mature flax no advantage appeared in harvesting with the windrow harvester, so far as reducing the moisture content was concerned. Where weeds are present, or in case it is desired to harvest before the crop is fully ripe, the windrower makes it possible to harvest before the crop is ready to combine.

All observations indicated that the moisture content of the seeds in standing flax increases rapidly after light rain or heavy dew and is responsive also to changes in humidity. When the moisture content of the seeds is high, a marked reduction in moisture may occur during the day. The rapid rate of drying on a clear day was shown by the moisture content of seeds from standing flax collected at hourly intervals.

The higher moisture content of the seed from the combine than from the standing flax indicates that the threshed seed took up moisture from the weed seeds and chaff present in the combine samples. After flaxseed containing dockage is placed in storage, moisture is transferred from the weed seeds to the flaxseed until there is equilibrium of moisture in the various contiguous seeds. Ordinarily when this balance is reached, the dockage contains from 1 to 3 per cent more moisture than the flaxseed.

At University Farm, St. Paul, Minn., there was no significant difference in the yield per acre of the Redwing variety from the five dates of harvesting, and no decrease in acre yield occurred from the later dates of harvest at Morris, Minn.

It seems probable that clean flaxseed containing not over 11 per cent of moisture is safe for storage in cool weather, and that flaxseed containing from 10 to 11 per cent of moisture may be considered safe for storage under average conditions. It was evident that flaxseed which varies greatly in moisture content also has a considerable range in value.

The morphology of the spikelets of six genera of Oryzeae, P. WEATHERWAX (*Amer. Jour. Bot.*, 16 (1929), No 7, pp. 547-555, figs. 13).—The genera considered embrace *Oryza*, *Zizania*, *Leersia*, *Zizaniopsis*, *Hydrochloa*, and *Luziola*.

Daily growth of the oat kernel and effect on germination of immaturity and controlled low temperatures, E. G. BOOTH (*Minnesota Sta. Tech. Bul.* 62 (1929), pp. 42, figs. 9).—The progressive development of the kernels of Gopher oats was studied from pollination to maturity, and samples of Gopher, Victory, and Banner oats in the early milk to ripe stages were subjected to controlled low temperatures at daily intervals. The technic is described in some detail.

The average flowering period in panicles lasted about eight days. Flowering progressed from the apex downward, so that the kernels in the lowest whorl were still in the late dough stage when apical kernels were ripe. The growth in length was more rapid during the first six days and then became more gradual until the maximum was attained on the fifteenth day. The width and thickness increased rapidly during the first 10 days and reached their maxima before growth in length ceased. The developmental period of the kernels studied continued for 15 days after pollination and ended when the glumes of the apical spikelet assumed a straw color. General ripening occurred in 2 days and was completed in 4 days, during which time the lemma and palea took on a uniform straw color and the moisture dropped from 41.5 to about 21 per cent.

The green weight increased rapidly for 13 days, but after the fifteenth day a pronounced decline occurred. The dry weight rose more gradually than the green weight until ripening began (on the fifteenth day). The increase in dry matter during the ripening period was 3 per cent of the maximum, and the loss when harvesting was delayed 2 days was 8.3 per cent. The nitrogen increased rapidly during the first 10 days and the ash during the first 12 days. Thereafter the quantity of nitrogen in 20 kernels fluctuated considerably, and differences in the amount of ash were very slight.

Exposure to controlled temperatures ranging from 31 to 27° F. for from 1 to 3 hours apparently did not affect germination, whether the samples were cooled

for 2 hours before the exposure or were placed in the chamber without pre-cooling. The average germination in the laboratory increased materially and the field germination still more with the accumulation of dry matter in the kernels. The average germination in the laboratory exceeded that in the field. In general the laboratory germination of immature samples was relatively high and did not indicate reliably what field results might be. With mature samples the laboratory germination always averaged slightly higher than the field tests but was a reliable index of field germination. Immature kernels made low field germination, and the seedlings lacked vigor.

Potted oats plants were particularly sensitive to low temperatures soon after pollination but endured the cold better when nearing maturity. Exposure during the developmental period to a temperature of 31° for 1 hour destroyed most of the green color in plants of Gopher oats.

Weight per bushel as a factor affecting the percentage of hull in oats [trans. title], R. RAYNAULD (*Sci. Agr.*, 10 (1929), No. 3, pp. 220, 221).—Observations on a number of oats varieties at Macdonald College, Quebec, showed that a direct relation may exist between weight per bushel and percentage of hull. Within a given variety the higher weights per bushel appeared to be associated with the lower percentages of hull.

Distribution of anthocyan pigments in rice varieties, J. W. JONES (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 9, pp. 867-875).—Of 980 varieties and strains of rice from Japan, Korea, and China and grown at the Biggs, Calif., Rice Field Station in 1927, 311 had color and 669 no color in one or more of the organs, including the internodes, nodes, leaf sheaths, leaf blades, ligules, auricles, glumes (outer or empty glumes), lemmas and paleas, lemma and palea apexes, awns, and stigmas which were examined for color before and after the plants reached maturity. The distribution of the pigments is discussed briefly, and data on awnedness in the varieties are included.

Potassium in relation to the shape of the sweet potato, W. R. ROBBINS, G. T. NIGHTINGALE, L. G. SCHERMERHORN, and M. A. BLAKE (*Science*, 70 (1929), No. 1823, p. 558).—Nutrition experiments with sweetpotatoes at the New Jersey Experiment Stations gave indications that an adequate supply of potassium may be essential for the production of chunky sweetpotatoes. It seemed probable that potassium may be necessary at some stage in order that there may be formed proteins of quality and quantity necessary for the rapid development of cambium, the tissue of the sweetpotato root chiefly responsible for increase in the number of cells and therefore in the thickness or chunkiness. Plants supplied with ample nitrate nitrogen in the nutrient solution produced sweetpotatoes comparatively high in organic nitrogen and relatively low in carbohydrates and distinctly chunky, whereas other plants receiving a smaller proportion of nitrates produced sweetpotatoes with a low percentage of organic nitrogen and higher percentage of carbohydrates and distinctly long. See also an earlier note (E. S. R., 52, p. 534).

The improvement of western rye grass, *Agropyron tenerum*, Vasey, L. E. KIRK (*Sci. Agr.*, 10 (1929), No. 4, pp. 239-250, figs. 3).—The present status and accomplishments of breeding work with western ryegrass or slender wheatgrass (*Agropyrum tenerum*) in Canada are reviewed. Improved strains are Grazier and Fyra, selected and tested by the Central Experimental Farm at Ottawa, and Mecca, selected by the University of Saskatchewan.

The drying of wheat (*Canada Natl. Research Council Rpt. 24* (1929), pp. 122, pl. 1, figs. 16).—This is a detailed report of investigations noted earlier from another source (E. S. R., 60, p. 137).

Dominion Grain Research Laboratory, Winnipeg, Man. [first and second annual reports], F. J. BIRCHARD (*Canada Dept. Trade and Com., Grain*

Research Lab. Ann. Rpts. [1928], pp. 8; 2 (1929), pp. 14).—The activities of the laboratory during the two years ended January 31, 1929, included studies of the moisture relations, quality, and milling and baking values of market grain.

Drying experiments with the various grains under commercial conditions, conducted at the elevators at the head of the Great Lakes, showed that nearly always the grain was dried to a moisture content lower than necessary for safe warehousing. The differences between the percentage loss (actual) on drying and that calculated from the moisture content before and after drying were not great. In laboratory small-scale experiments the loss on drying was due to moisture only, any other losses being comparatively insignificant. When flaxseed was dried at 175° F. or over, a slight increase in weight which took place over and above the moisture loss was attributed to the partial oxidation of linseed oil in the seed. If the temperature did not exceed 152° no increase in weight took place. A study of experimentally dried samples of grain suggested that when properly dried no deterioration occurs in the quality, and that often an improvement takes place, particularly in color and very often in volume and texture as well. Indications were that durum wheat will carry safely about 0.5 per cent more moisture than Marquis wheat of the same weight per bushel.

According to milling and baking tests during 12 years on the principal wheats grown in western Canada it was shown that compared to Marquis, Kitchener, Red Bobs, Early Triumph, Ruby, Supreme, Red Fife, and Reward are first class milling and baking wheats. Stanley, Kota, Preston, Garnet, Vermilion, Parker Marquis, Parker Selection, Quality, and Axminster did not equal Marquis or were undesirable in several characters. Axminster appeared to be one of the best white spring wheats. The milling and baking characteristics of the 1928 crop have been noted (*E. S. R.*, 60, p. 336).

The presence of 2 per cent of grass green kernels in otherwise sound No. 1 Northern wheat did not affect noticeably either the milling or baking quality. When the green kernels were increased to 3 per cent, the yield of patent flour was reduced about 0.5 per cent.

In the crop year 1927-28 the respective protein contents of wheat grading No. 2 and No. 3 Northern averaged in Manitoba 11.44 and 11.21 per cent. In Saskatchewan No. 1, No. 2, and No. 3 averaged 11.87, 11.65, and 11.6 per cent, and in Alberta 12.62, 11.63, and 11.27 per cent. In 1928-29 the averages for Manitoba were 12.47, 12.15, and 11.93 per cent; for Saskatchewan 12.08, 12.5, and 12.33; and for Alberta 12.67, 12.26, and 11.88 per cent.

Work of the seed testing laboratory (*New York State Sta. Rpt. 1929*, pp. 41-43).—The activities of the laboratory in official and routine seed testing, seed studies, and disease tests are reviewed for the year ended June 30, 1929.

A drill survey in which samples of seed were taken from grain drills in the field in the fall showed the importance of properly cleaning and treating seed wheat. Many samples from the drills showed that the seed was unfit and even seriously objectionable for planting.

Comparative field trials of 112 lots of seed corn showed that many descriptive names used for varieties were meaningless, often confusing, and sometimes misleading. Certain lots of western corn offered as silage corn proved unsatisfactory for New York. At the first frost these lots were still in the milk or soft stage and made very poor silage.

A study of the comparative morphology of the seeds of *Agropyron*, F. E. FOULDS (*Sci. Agr.*, 10 (1929), No. 3, pp. 200-219, figs. 10).—The morphological characters of the seeds of 14 species pertaining to *Agropyron* are

described and illustrated from extensive studies at the University of Manitoba and elsewhere.

Acidity changes in stored legume seeds, J. K. WILSON (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 8, pp. 815-817).—The pH readings made at Cornell University on seeds of different species of legumes, running from fresh seed to seed 10 years old, gave indications that aging of seed is accompanied by a change in reaction. In most samples acidity has increased with age.

The Indian oat and the error in its identification, R. D. ROSE (*Agr. Jour. India*, 24 (1929), No. 3, pp. 169-174, pls. 2).—Indian oats are identified as pertaining to *Avena sterilis*.

Chemical eradication of ragwort, R. E. R. GRIMMETT (*New Zeal. Jour. Agr.*, 39 (1929), No. 4, p. 256).—Placing about 1 oz. of a dry mixture of equal parts of finely crystallized iron sulfate and agricultural salt on the crown of each plant is reported to have controlled ragwort. The application is probably more effective in the spring.

HORTICULTURE

[Horticultural investigations at the New York State Station] (*New York State Sta. Rpt.* 1929, pp. 26, 27, 39, 46, 60-70).—Again briefly summarizing (E. S. R., 60, p. 437) progress in various lines of activities, it is reported that French crab seedlings grown under controlled conditions of the greenhouse varied exceedingly in their response to similar treatments, indicating inherent variability and suggesting other causes for differential orchard responses besides soil heterogeneity.

Finding that the amounts of arsenical residue on samples of apples obtained from various sections of the State were uniformly lower than the world tolerance of 0.01 grain of arsenious oxide per pound of fruit, it is concluded that objectionable residues occur only where excessive or very late applications of arsenicals are made.

Important accessions to the extensive variety plantings included 114 varieties of grapes from Russia, France, and northern Africa, and 47 kinds of nuts. Among promising new fruits were the Kahalili grape, Rivers Orange nectarine, Viking raspberry, Ewart pear, Lloyd George raspberry, Wyona strawberry, and Marigold peach. Breeding work was continued with customary vigor, approximately 2,700 apple, pear, cherry, peach, nectarine, and plum seedlings being planted out for testing and descriptive notes taken on a large number of strawberries, raspberries, grapes, and other fruits.

Propagation studies continued to show Myrobalan stocks superior to St. Julien, peach, Americana, and Marianna for plums. Sweet and sour cherries continued to thrive better on Mazzard than on Mahaleb roots. Rome apple trees propagated from high and low yielding parents showed no marked differences. Red sports of Duchess, Gravenstein, Northern Spy, Rome, King, Twenty Ounce, and Delicious showed promise.

Vegetable investigations included descriptive studies of a large number of varieties of sweet corn, cucurbits, asparagus, carrots, parsnips, rhubarb, okra, martynia, leeks, red celery, peppers, eggplants, and tomatoes. In field fertilizer studies with tomatoes and cabbage, phosphorus was found of outstanding importance. In the case of tomatoes 1,200 lbs. per acre of 4-16-4 (N-P-K) fertilizer gave larger net returns than did lesser amounts. Tomato breeding resulted in some promising seedlings and selections. John Baer proved the best yielding canning tomato. Tomato plants from seed sown March 25 outyielded those of March 10 and April 10, respectively. Transplanting in the seedling stage proved desirable. Spaced 3.5 by 4 ft., tomato plants yielded the largest net returns.

Fertilizer experiments indicated that the form of potash had little, if any, effect on the hardness of peas, and that it is not the chloride radical in potassium chloride that causes premature ripening and hard peas. All forms of potash tended to hasten maturity and slightly increased the proportion of larger sizes but did not increase total yields. Both potassium chloride and potassium sulfate tended to make hard peas in the canned product. Pea breeding included a study of 27 hybrids in the third generation. Grading pea seed for size had no effect on maturity, yield, or quality. Seeding at the rate of 5 bu. per acre gave the largest net returns. Disinfection with organic mercury compounds generally increased germination, but inoculation was not beneficial. Time-of-planting studies indicated the desirability of early seeding. Drilling fertilizer directly with the seed proved harmful in the case of beans and peas.

Grading sweet corn seed to size increased uniformity of maturity, and it was found that the crop from large seed was earlier. The largest returns from Golden Bantam were secured with hills spaced 30 in. each way and with 4 plants per hill. Early Evergreen was most profitably spaced 3 ft. each way. Disinfection of sweet corn seed increased early germination but had no significant influence on yields.

Comparisons of 104 lots of fruit and rose stocks obtained in the United States and Europe showed the imported stocks to be uniformly superior to the general run of native stocks. However, certain strains of domestic seedlings were very good. Domestic seed was generally of higher viability than imported seed, and certain varieties of apple, pear, cherry, and peach yielded desirable type seedlings, while others yielded inferior progeny. The production of seedling stocks is again discussed (E. S. R., 61, p. 524). Studies upon the storage of nursery stocks showed the importance of allowing the stock to ripen properly in the field, such material being more resistant to cold and disease in the cellar. A collection of asexually propagated stocks was assembled for studies in propagation. Results of fertilizer studies with apple, cherry, and rose stocks failed to show any response to nitrate of soda, stable manure, urea, superphosphate, and potassium chloride used alone or in combination.

Asparagus breeding in Schwetzingen [trans. title], LIEBER (*Mitt. Deut. Landw. Gesell.*, 44 (1929), No. 5, pp. 114-118, figs. 7).—Following a discussion of cultural methods, the author states that the majority of high-yielding asparagus plants were males and also that the male plants lived longer than females. In breeding, the selection of female plants is considered of particular importance, since the female is the less productive parent and since differences as large as 300 per cent were noted in the yields of individual females. A variety of asparagus designated as Unselts Improved Schwetzingen was recently disseminated to the growers.

The determination of nitrate in green tomato and lettuce tissues, E. M. EMAERT (*Plant Physiol.*, 4 (1929), No. 4, pp. 519-528).—Gratifying results were obtained by triturating green tissues with calcium hydroxide and filtering from copper hydroxide. Enzymes, sugars, and other reducing substances in the amounts found in tomato tissue did not reduce nitrate in solutions made strongly alkaline with calcium hydroxide.

The analysis of tomato plants, Part I, O. OWEN (*Jour. Agr. Sci. [England]*, 19 (1929), No. 3, pp. 413-432, figs. 2).—Finding that under the conditions obtaining at the Cheshunt Experimental and Research Station, England, phosphorus fertilizers had no significant influence on yields of tomatoes, analyses were made of the plant and fruit from plats fertilized in various manners. In the case of plants grown with complete fertilizer the ratio of potash,

phosphoric acid, and nitrogen was in the order of 9:1:5. The ratio of green vegetation to fruit on the complete fertilizer plats was 1:1.6, while on unmanured plats the ratio of vegetation to fruit was 1:2.6. Of the nutrients taken up, more than half the total nitrogen and two-thirds of the total potash was used in vegetative growth. At the same time slightly more than half the phosphorus went into the fruits. The amount of phosphorus taken up by the manured plants was less than that taken up by the unmanured plants, leading to the deduction that there must exist some degree of interdependence between the three nutrients. Indications were that the phosphorus requirements of the tomato were unusually low at Cheshunt.

Analyses of leaves and shoots taken at different seasons suggested that actively growing tissue is richest in all the three nutrients, and of the clusters on a plant the third and fourth were richest in the nutrients concerned. The relative amount of potash in the whole of the above-ground portion of the tomato tended to decline as the season advanced.

Containers for plant growing, J. E. KNOTT and C. D. JEFFRIES (*Pennsylvania Sta. Bul.* 244 (1929), pp. 16, figs. 14).—A study of the causes underlying variations in the growth of young vegetable plants as related to the container in which grown showed a direct relationship between plant growth and the substance from which the container was made. Containers of pulp or paper were attacked by cellulose-decomposing organisms which utilized the nitrates of the soil, consequently causing inferior growth. New clay pots were decidedly inferior to used pots, apparently because of their absorption of nitrates, as was indicated in an examination of new and old pots.

Of remedial measures it is suggested that treating paper pots with asphalt, wax, or other chemical will reduce the rate of decomposition, thereby reducing the drain on nitrates. It is pointed out, however, that the addition of liquid manure or of dissolved nitrates whenever plants turn yellow or become stunted enables the growing of good plants in any of the several containers.

New solvents for the removal of arsenical spray residue, R. H. ROBINSON (*Indus. and Engin. Chem.*, 21 (1929), No. 11, pp. 1132-1135, fig. 1).—In studies conducted while temporarily associated with the U. S. D. A. Bureau of Chemistry and Soils, the author found that lead arsenate placed in various solvents for definite periods dissolved most rapidly in acids, whether hydrochloric, nitric, or sulfuric. These acids dissolved the maximum amount of the arsenical in 5 minutes, with no increases after 10 and 30 minutes. Practically the same results were attained in 2 minutes. Solubility was much slower with bases, and in the case of those used the lead was precipitated as hydroxide or carbonate. None of the salts tested as solvents gave promise. Combinations of certain sulfates or chlorides with hydrochloric acid increased its effectiveness as an arsenical remover, sodium sulfate being the most promising of the various substances tested. A lower concentration of acid was required in the combination solvent, hence reducing the possibility of injury to the fruit.

Some seasonal changes in the tracheal sap of pear and apricot trees, F. G. ANDERSEN (*Plant Physiol.*, 4 (1929), No. 4, pp. 459-476, figs. 7).—In a preliminary study of the tracheal sap obtained by the gas displacement method from the main branches of 3-year-old Bartlett pear and Royal apricot trees, it was determined at the University of California that the buffer value of tracheal sap at the middle of spring was about one twenty-fifth that of the expressed sap from the same tissue. Maximum acidity was reached in both

tracheal and expressed sap in early spring and declined gradually to a minimum in winter. The change from the winter minimum to the spring maximum was, on the other hand, very rapid, coinciding with growth resumption. Total electrolyte concentration and increased acidity of the tracheal sap ran parallel.

Individual inorganic constituents in the tracheal sap increased in concentration from early winter to early spring. The large increase in phosphate observed between late winter and early spring is believed the result of phosphate set free in starch hydrolysis. Free reducing substances and sucrose found in high concentration in late winter and early spring were at this season limited to the outer annual ring in 3-year-old pear branches. Total electrolytes were about twice as concentrated in the outer annual ring as in the inner rings, and the sap of the outer annual ring was more acid. Total solids rose during the winter months, declined during spring, and remained at a relatively uniform level the balance of the year.

Preliminary budding is useful in certain cases, F. C. BRADFORD (*Michigan Sta. Quart. Bul.*, 12 (1929), No. 2, pp. 39, 40).—Pear shoots into which buds of desired varieties had been inserted in August were successfully utilized as scions in whip grafting and later made very satisfactory growth. This method is deemed of potential value in double working and in the propagation of poor rooting plants.

Errors in methods cause faulty graft unions, F. C. BRADFORD (*Michigan Sta. Quart. Bul.*, 12 (1929), No. 2, pp. 58-61, figs. 2).—A microscopic examination of various faulty grafts of pear and apple failed to show any evidence of cambium and phloem breaks, such as characterize truly uncongenial unions, and led to the conclusion that faulty methods of technic, such as neglect to set the scion in correct alignment, were causal factors.

Pollination studies [trans. title], E. JOHANSSON (*Sveriges Pomol. För. Årsskr.*, 30 (1929), No. 1, pp. 23-36; *Eng. abs.*, pp. 35, 36).—Tabulated data presented on the percentage germination in 20 per cent sugar solution of the pollen of a large number of apple, pear, plum, and cherry varieties show in general excellent growth. In many varieties, especially plums, the addition of the stigmas of the same variety to the sugar solution increased germination, but in a few apples and pears stigmas apparently reduced pollen development. In certain cherries poorer germination was observed near the stigmas, while at some distance there was an evident stimulation. The addition of stigmas of other varieties was frequently more stimulating than was the inclusion of stigmas of the same variety.

The cause of hairy root on apple seedlings, T. J. MANEY (*Natl. Nurseryman*, 36 (1929), No. 17, pp. 6, 7, 8, 9, 16, figs. 7).—Evidence is presented to suggest that hairy root of apple trees is not necessarily pathological but often simply the development of numerous roots from burrknot primordia.

Changes in the pectic constituents of apples in relation to softening, M. H. HALLER (*Jour. Agr. Research* [U. S.], 39 (1929), No. 10, pp. 739-746, figs. 3).—Determinations of the pectic materials in apples at various stages of maturity and stored at various temperatures showed quite definitely that changes in pectic constituents are directly associated with softening of the fruits, as recorded by the pressure tester. The amount of soluble pectin in apples as they ripened on the tree was found to be very small and practically constant. Softening on the tree appeared to be associated in part with the apparent decrease in protopectin content due to the enlargement of the fruits. Other factors, such as increase in the size of cells and intercellular spaces, are deemed important factors in the softening of growing fruits.

In storage at 32° F. there was observed a regular increase in soluble pectin due largely to the hydrolysis of the protopectin. No correlation was established between pectic constituents and firmness; in fact, Jonathan apples, much softer than Winesap and Ben Davis, had a higher protopectin and total pectin content. Softening in storage is believed due to the conversion of insoluble pectic substances, principally protopectin, into soluble forms. The changes in pectic constituents at the various temperatures utilized, 32, 40, 50, and 60°, were proportional to the rates of softening at the respective temperatures.

A comparative study of the developing and aborting fruits of *Prunus cerasus*, D. BRADBURY (*Amer. Jour. Bot.*, 16 (1929), No. 7, pp. 525-542, pls. 4, figs. 4).—A further report (E. S. R., 56, p. 536) from the Wisconsin Experiment Station on the underlying causes of dropping of immature cherries of the Early Richmond and Montmorency varieties. The conclusion is reached that neither lack of pollination nor failure of the tubes to reach the ovarian cavity is an important factor in dropping, but that unfavorable nutritional conditions are probably the primary causes. This conclusion was borne out by the fact that following winterkilling of a considerable portion of the blooms the percentage of the remainder to set was larger than in the case of full bloom. In some instances degeneration was observed in the ovules prior to the opening of the flowers.

Dropping occurred in three rather distinct waves, the fruits of each of which has certain characteristics. Both ovules were shriveled in most of the drops of the first wave, and the pollen tubes appeared to have grown at random throughout the upper portion of the ovarian cavity. The embryo or endosperm was degenerate in many of the fruits of the second wave, and in some entire contents of the embryo sac were disorganized. The embryo was degenerate in some of the fruits of the third wave.

Inflorescence types of strawberry varieties, G. M. DARROW (*Amer. Jour. Bot.*, 16 (1929), No. 8, pp. 571-585, figs. 6).—Observations on a large number of varieties and seedling strawberries growing at the U. S. Plant Field Station, Glenn Dale, Md., showed characteristic differences in the number and type of inflorescences and in the number of flowers per inflorescence. However, various environmental factors, such as fertility of the soil, played a rôle. Records taken on a large number of clusters of certain varieties showed the first or primary blooms to bear the largest berries, with this tendency more marked in varieties with long peduncles than in those with short peduncles. Under like conditions plants with short peduncles produced relatively more large fruits than did those with long peduncles, because the secondary berries were nearer the size of the primary berries in the short peduncle plants. The parental species, *Fragaria chiloensis* and *F. virginiana*, were also analyzed, with comments on the possible origin of the branching habits in cultivated varieties.

Mulching strawberries paid well at college, R. E. LOREE (*Michigan Sta. Quart. Bul.*, 12 (1929), No. 2, pp. 52, 53).—Mulching Gibson strawberries in the fall of 1926 increased yields above the cost of the mulch but because of mild weather had no material effect on the percentage of winterkilling. However, the berries of mulched plants were cleaner, brighter, and of higher grade.

Profitable pruning of the Concord grape, N. L. PABTRIDGE (*Michigan Sta. Spec. Bul.* 141, rev. (1929), pp. 14, figs. 11).—A revision of an earlier noted bulletin (E. S. R., 53, p. 40), suggesting a proximate pruning schedule for the grape based on the weight of prunings rather than on the number of buds.

Suggestions to grape growers from experiments in California, G. C. HUSMANN (*Calif. Fruit News*, 80 (1929), No. 2160, p. 5).—A list of phylloxera resistant grape stocks is presented, together with notes concerning soil types to which each stock is best adapted.

A study of the phylogenetic relationships of the rutaceous subfamily Citratae, including the citrus fruits and their wild relatives, with experimental studies in the hybridizing and grafting plants of this subfamily, W. T. SWINGLE (In *Proceedings of 3. Pan-Pacific Science Congress, Tokyo, 1926*. [Tokyo: Natl. Research Council of Japan], 1928, vol. 2, pp. 2013, 2014).—This is an abstract of a paper presented before the third Pan-Pacific Science Congress, Tokyo, 1926.

Discussion of the pomology of the most important Pacific races of citrus fruits, T. TANAKA (In *Proceedings of 3. Pan-Pacific Science Congress, Tokyo, 1926*. [Tokyo: Natl. Research Council of Japan], 1928, vol. 2, pp. 2002–2011).—Detailed information is presented on various species and varieties of citrus grown in the Orient, particularly Japan, and the need is pointed out of wider knowledge and dissemination of existing forms, some of which are deemed highly desirable and very worthy of greater use.

Bud selection in the Washington Navel orange: Progeny tests of limb variations, A. D. SHAMEL, C. S. POMEROY, and R. E. CARYL (*U. S. Dept. Agr., Tech. Bul. 123* (1929), pp. 72, figs. 42).—A summation of studies, the results of which have been in part previously noted from time to time (E. S. R., 57, p. 438), upon the occurrence of bud variations in the Washington Navel orange and upon the transmission of these off-type characteristics to the asexual progeny.

From extensive observations, the authors conclude that there are in southern California at least 20 strains of Washington Navel of commercial importance and 5 or more of lesser value, all of which possess distinctive vegetative or fruit characteristics or both. In some orchards there was found approximately 25 per cent of inferior type trees, contrasting decidedly with young orchards grown from selected buds and in which there was an almost complete absence of undesirable types.

Systematically conducted progeny studies reviewed in considerable detail showed that desirable and undesirable characteristics both in vegetation and in fruit are transmitted to succeeding generations. Among the fruit variations noted are differences in yield, shape, quality, amount of juice, etc. Inferior type trees were successfully reworked by top grafting.

The root-grafting of citrus trees, K. NAGAI and I. TAKAHASHI (In *Proceedings of 3. Pan-Pacific Science Congress, Tokyo, 1926*. [Tokyo: Natl. Research Council of Japan], 1928, vol. 2, pp. 2014–2022).—A method of inarching old or weakened citrus trees with young, vigorous stocks is described and data presented on subsequent growth of the tops and roots and upon the production of fruit. The method outlined proved particularly valuable in rejuvenating Thomson oranges originally budded on *trifoliata* stock.

On citrus pollination, K. NAGAI and T. TANIKAWA (In *Proceedings of 3. Pan-Pacific Science Congress, Tokyo, 1926*. [Tokyo: Natl. Research Council of Japan], 1928, vol. 2, pp. 2023–2029).—Studies with a total of 35 varieties representing 5 species of citrus showed great variability in respect to pollination requirements. Pollen placed in 20 per cent cane sugar solution varied in germination from 0 in the case of 4 varieties to 96 per cent as a maximum. The Washington, Thomson, and Navelencia oranges were imperfect in both the male and female organs, the fruit being produced parthenocarpically. With these varieties cross-pollination only rarely resulted in seed.

Citrus culture in Japan, K. NAGAI (In *Proceedings of 3. Pan-Pacific Science Congress, Tokyo, 1926*. [Tokyo: Natl. Research Council of Japan], 1928, vol. 2, p. 2012).—An abstract is presented of a paper dealing in a general way with the location and size of the industry, varieties, methods of propagation, pruning, fertilization, etc.

The root system of pineapple plants, F. A. I. BOWERS (*Hawaii. Pineapple Cannery Sta. Bul. 12* (1929), pp. 35, figs. 12).—Citing the fact that pineapple roots are severely attacked by various enemies, such as nematodes, fungi, and insects, which greatly modify growth and apparently destroy many secondary roots and root hairs, the author discusses root growth as observed in the laboratory and in the field. Correlations determined between root and top growth indicated a rather constant ratio, larger in older plants. A correlation coefficient of 0.66 ± 0.03 was established between the number of leaves and the number of roots in 220 plants. Nematode injury greatly modified root formation, often inducing branching of the primary roots. Of crowns, slips, and shoots used in propagation, the first usually gave the largest volume of roots and the third the smallest.

Studies of the effect of various fertilizer materials on root growth showed that certain materials, particularly phosphorus, have a marked influence. Placing the fertilizer in the lower soil did not tend to induce downward growth suggesting the advisability of placing fertilizers where they can be reached. Fertilizer response was not observed until the secondary roots appeared, suggesting that the pineapple plant is able at first to grow quite independent of environment. The penetrative ability of the root system was closely associated with the character of the soil, but generally fully 80 per cent of the roots were located in a soil cylinder 20 in. across and 6 in. deep. Paper mulch tended to hold the roots near the surface.

Behavior of pineapple plants in water cultures of varying hydrogen ion concentrations, C. P. SIDENIS (*Hawaii. Pineapple Cannery Sta. Bul. 4* (1926), pp. 15, figs. 4).—Using as plant material pineapple slips carefully selected for uniformity and grown in cultural solutions, it was found that the greatest total root length was obtained at a pH of 5. Root hairs were conspicuously absent at pH 7 and 7.5 and few and small at 6.5. Stem and leaf development at the different pH values corresponded closely to root behavior. Pineapples appeared much more tolerant to low than to high pH values. In well-balanced cultural solutions 6 weeks' growth produced only slight changes in H-ion concentration, all solutions tending to become slightly more acid. The addition of ammonium sulfate greatly increased acidity, the ammonium radical being apparently rapidly removed, leaving sulfate ions. Sodium nitrate produced but little effect, the pH practically checking the values for the basic culture solutions. Calcium nitrate added to solutions of higher H-ion concentration caused a marked decrease in hydrogen ions, but at pH 6 or above the acidity remained stationary. Some change in H-ion response was noted as the plants became older.

Persistence of characters in the Smooth Cayenne pineapple, K. KERNS (*Hawaii. Pineapple Cannery Sta. Bul. 11* (1928), pp. 15, figs. 6).—Noting variability in Smooth Cayenne plants in a single field, despite the fact of asexual propagation, careful records were taken on a block of 600 odd plants in a plant-crop field. The coefficients of variability for the weight of fruits were 17.35 ± 0.0259 , 18.36 ± 0.0458 , 22.95 ± 0.0808 , and 24.12 ± 0.0281 , respectively, for the original plant crop, the crown planting, the shoot planting, and the slip planting. The crown plants produced the largest fruits. Correlations determined between fruit weight of the mother plants and of the progeny plants were small, 0.2606 ± 0.01702 between the 1925 and 1927 plant crops, and 0.2981 ± 0.02932 between the 1925 plant crop and the 1926 ratoon crop. Records taken on the fruit showed almost a total lack of correlation in the inheritance of shape and only a slight inheritance in diameter:length ratio between successive generations and no marked correlation within a single generation.

Studies of the behavior of the progeny of plants bearing heavy and light fruits showed some advantage in selecting large-fruited parents, the result being thought due to the greater vigor of the heavy-fruited lot. Selection on the basis of the diameter to length ratio gave no results. Measurements are presented for a typical Smooth Cayenne fruit. In general conclusion the authors suggest that the Cayenne pineapple must be highly stable and homogenous, no strains or heritable variations being observed. The advisability of selecting propagating material from strong plants was shown. Although no better types were discovered, the possibility of their existence is conceded.

Vegetative propagation of holly, P. W. ZIMMERMAN and A. E. HITCHCOCK (*Amer. Jour. Bot.*, 16 (1929), No. 7, pp. 556-570, pls. 3).—In an investigation conducted at the Boyce Thompson Institute for Plant Research and at the Maryland Experiment Station it was noted that the percentage of rooting varied not only between holly species but between individual trees within a species. Removal of all foliage prevented rooting of cuttings of evergreen hollies, but in deciduous species was not a factor. The period August 1 to January 1 was most successful for rooting holly cuttings. In general, cuttings comprising current-season wood were best, though a heel of older wood was not harmful. Of five soil mediums tested, a mixture of one-half peat moss and one-half sand by volume gave the best results. Rooting took place over a pH range of 3.6 to 8. A temperature range of 65 to 75° F. gave the best results.

Ilex opaca cuttings gathered October 5 showed only traces of starch, with abundant reducing substances. On December 15 cuttings which had rooted showed an abundance of starch, with reducing substances practically gone. A comparable change occurred in the twigs of trees outdoors. In the case of *I. crenata* placed in light and darkness in the greenhouse on November 16, cuttings in darkness and at temperatures of 50 and 59° lost all their starch in 6 weeks, while cuttings in the light and those in darkness at 41° still contained starch. No rooting occurred in darkness. Potted plants of *I. opaca* when properly pollinated produced berries the first season.

How to grow roses, R. PYLE, J. H. MCFARLAND, and G. A. STEVENS (*New York: Macmillan Co.*, 1930, 17. ed., enl. and rewritten, pp. 210, illus. 130).—An enlarged and entirely rewritten edition of the previously noted book (E. S. R., 52, p. 741).

FORESTRY

Improved forest tree seed: A suggested study, P. COVILLE (*Jour. Heredity*, 20 (1929), No. 10, pp. 459-467, figs. 5).—Pointing out that the individual trees within a forest species may vary decidedly in form, vigor, etc., the author suggests the desirability of determining the hereditary characteristics of many qualities, such as growth rate, strength and density of wood, susceptibility to various insects and fungi, resin content, etc.

Make yield table for second growth hardwoods, A. K. CHITTENDEN (*Michigan Sta. Quart. Bul.*, 12 (1929), No. 2, pp. 42-44).—Based on data taken in 39 sample plats in the northwestern portion of the Lower Peninsula of Michigan, a yield table is presented for second-growth hardwoods. Timber suitable for saw logs requires at least 70 years for growth, the average diameter at this age being 9.7 in. Removal of the crooked and defective trees accelerated the growth of the remainder.

DISEASES OF PLANTS

[Report of the] division of botany (*New York State Sta. Rpt. 1929, pp. 36-38, 39, 40, 41*).—Based on sprouting tests with Rural New Yorker No. 2, Green Mountain, and Irish Cobbler seed potatoes, it is reported that tubers affected with leaf roll produce mostly spindling or slender sprouts, but with sufficient exceptions to render diagnosis on this basis subject to error.

Of the two destructive mosaic diseases of the raspberry, namely, red and yellow mosaics, the former was found increasingly prevalent in black raspberry plantings in western New York, and the latter appeared in numerous Columbian purple plantings and was very abundant in the Cuthbert red variety. That weather conditions greatly affect the symptoms of mosaic was shown in 1928 when, for example, the red mosaic was masked and outgrown in the black raspberry.

Studies of the effects of sulfur fungicides on the health and fruitfulness of orchard trees progressed sufficiently to indicate that sulfur may injure the foliage under certain conditions of physiological activity, and that such injury may be prevented within certain limits.

In studies upon cherry leaf spot it was found that the vigor of the tree, as well as the leaf spot fungus, may be concerned in defoliation. The degree of vigor was checked by measurements of annual growth, and lack of vigor was traced in some cases to winter injury of the roots. On the other hand, weak growth may result from defoliation. Physiological disturbances brought about by extended spring rains also induced yellowing and dropping of leaves. Primary leaf spot infection occurred early in June, 1928, necessitating at least one additional spray besides the two used for fruit fly control.

Although bridge grafting and inarching were successfully employed in saving crown or root injured apple trees, the wisdom of the treatment is questioned because of the slow return to a point of profitable production.

An outbreak of Brooks' fruit spot of apples occurred in the Hudson Valley in 1928, but no evidence was secured that the amount of the disease increased after storing.

Attempts to control cucumber mosaic on Long Island by the eradication of susceptible weeds having proved futile, pure-line breeding was resorted to, with the result that lines showing distinct mosaic resistance were obtained. Inbreeding did not reduce vigor but did produce many abnormal forms.

That mercury and copper compounds used in seed treatment and spraying may be harmful was shown by the fact that Lima bean seeds dusted with a mercury compound yielded smaller and less productive plants than did untreated seed. At the same time string beans were not affected.

The hot water treatment of cauliflower seed, as discussed in Bulletin 550 (E. S. R., 59, p. 50), was successfully employed in the prevention of black rot.

The tendency of the crown-gall organism to produce roots in conjunction with tumors, N. A. BROWN (*Jour. Agr. Research* [U. S.], 39 (1929), No. 10, pp. 747-766, figs. 10).—Studies in the Bureau of Plant Industry, U. S. D. A., showed that the strain of crown gall isolated from apple trees may produce both roots and tumors, which are deemed symptoms or manifestations of the same disease. Isolations of the apple strain produced fewer virulent colonies and had less host plants than did any other strain except the rose. The rate of infection by the apple strain was slow on all species, including the apple. When inoculated with the apple strain the Paris daisy and *Impatiens balsamina* produced both roots and small tumors; the rose and bean stems produced definite tumors instead of masses of roots; *Bryophyllum pinnatum* produced

masses of roots and tumors without roots; tobacco, geranium, and *Ricinus* produced a few inconspicuous outgrowths without roots; and the tomato was unaffected.

When first isolated the apple strain differed in appearance from all other cultures except the rose, with these differences disappearing after the apple strain had passed through another host. The reisolated colonies were more virulent than the original ones. Root production is also stimulated by the peach, hop, poplar, chrysanthemum, and other strains of crown gall.

The rusts of Pennsylvania. F. D. KERN, H. W. THURSTON, JR., C. R. ORTON, and J. F. ADAMS (*Pennsylvania Sta. Bul.* 239 (1929), pp. 53).—A classification, with descriptive notes, is presented on a total of 158 species of rust fungi belonging to 21 genera, occurring on 412 species of hosts, representing 61 families and 183 genera of higher plants. Of the 158 species of rust, 80 are heteroecious and 69 autoecious, with no data on the other 9.

The preparation and effectiveness of basic copper sulfate as a fungicide. E. B. HOLLAND, C. O. DUNBAR, G. M. GILLIGAN, and W. L. DORAN (*Massachusetts Sta. Bul.* 254 (1929), pp. 123-149).—Following a discussion of the composition and preparation of basic copper sulfates, data are presented on the results of four years of field trials with the materials as control for diseases of various vegetables and fruits. In general, good results were secured with the vegetables, but with the fruits progress was not as satisfactory, the sulfates causing foliage and fruit injury in some cases.

The low basic sulfate appeared to be slightly more effective per unit of copper than the high basic sulfate, due, in the authors' opinion, to better physical condition. Due to a lower dispersion, a greater copper concentration was, in some instances, necessary in basic sulfate than in Bordeaux in order to secure equal control. The larger proportion of inert vehicle in dusts causing a depression in the activity of the fungicide necessitated greater concentration of copper than in sprays. Recommended amounts are presented for both sprays and dusts. Since basic copper sulfates are insoluble compounds, it is advised that they must be applied at the proper time and concentration to insure adequate protection.

Origin of a segregate resistant to black-stem rust in a cross between two susceptible parents. G. STEWART (*Amer. Nat.*, 62 (1928), No. 679, pp. 188-192).—H. K. Hayes, O. S. Aamodt, and F. J. Stevenson¹ are stated to have obtained from a cross, Minard \times Minhardi, some segregates that were semiresistant to black-stem rust, though both plants were susceptible, and they are credited with the view that "recombination of genetic factors evidently occurs in these winter wheat crosses whereby a cross of two susceptible varieties leads to the production of some semiresistant types." They are said to have obtained several such segregates.

Some segregates showing full resistance had been obtained by the present author during 1924 and 1925 in a cross between Dicklow, which is completely susceptible, and Sevier, which has some pure lines that are completely susceptible, some showing, however, various degrees of partial resistance. The opinion was held that these somewhat resistant segregates had originated by transgressive segregation rather than by direct transmission from a resistant parent, though the original pure line of Sevier was not known, and the cases were thus not completely definite.

Data are presented which were obtained in 1926 and 1927 and which give, with considerable frequency, recombination of genetic factors, as a result of which segregates are produced that are more resistant to black-stem rust than

¹ Jour. Amer. Soc. Agron., 19 (1927), No. 10, pp. 896-910.

either of the parental lines. This fact tends to substantiate the view that resistant lines previously obtained arose by transgressive segregation and corresponds also to data reported from the Minard \times Minhardi cross.

This is regarded as a definite and important case in which a segregate having a really resistant reaction was obtained from a cross in which one parent was fully susceptible and the other slightly semiresistant. It is thought to present clear-cut evidence that highly important recombinations of considerable magnitude occur in the genetic factors having to do with the inheritance of reaction to black-stem rust, whereby resistant lines are obtained from crosses of susceptible lines. Additional evidence is also furnished as to the complexity of plant genetics.

The percentage of leaf rust infection is not very different in the three groups of segregates as classified according to their reaction to black-stem rust. The evidences accredited to the investigators above referred to, as to a correlation between resistance to black-stem rust and susceptibility to leaf rust, are said to be lacking in the results obtained by the present author.

Factors which modify the resistance of wheat to bunt, *Tilletia tritici*, F. N. BRIGGS (*Hilgardia* [California Sta.], 4 (1929), No. 7, pp. 175-184).—That the infection of a few plants in genetically resistant stocks is due to the presence of modifying factors rather than the infection of genetically resistant plants was suggested in studies of the performance of the progeny of diseased and of healthy plants, both from the same genetically resistant stock. Populations raised from the seed of partly bunted plants usually had a higher average percentage of infection than did populations from bunt-free sister sibs. Greater variation in the percentage of bunt in 1927 than in 1928 in rows from the same parent suggests that environmental conditions are also a factor. More serious injury in plants heterozygous for resistance than in plants homozygous for this factor is held to suggest the presence of more numerous or more potent modifying factors in the heterozygous lines.

Deficiency of magnesium the cause of a chlorosis in corn, J. P. JONES (*Jour. Agr. Research* [U. S.], 39 (1929), No. 11, pp. 873-892, figs. 4).—Observing that chlorosis of a nutritional type found in a field of corn at the Massachusetts Experiment Station could be overcome by applications of either magnesium sulfate or of lime, control studies were carried out in the greenhouse with chemically pure materials. In this case the magnesium sulfate was alone able to prevent chlorosis, indicating that the beneficial effects of the lime in the field had been due to its content of magnesium.

Chemical analyses consistently showed abundant aluminum in both the chlorotic and the normal plants, but magnesium was always higher in the latter. Where chlorosis affected a high percentage of the plants, total yields of seed were materially reduced, more so than was the stover.

Conditions inducing magnesium deficiency are said to be continuous cropping and the continued use of fertilizers free of magnesium on a light soil subjected to leaching. As determined in lysimeter studies, the leaching in the drainage water is a more serious factor in magnesium deficiency than is the removal of the element by crops.

Some conditions influencing the development of bacterial disease of cotton (*Bacterium malvacearum*), W. P. K. FINDLAY (*Empire Cotton Growing Rev.*, 5 (1928), No. 1, pp. 29-39, fig. 1).—This is an account of work done in Trinidad, with a view to determining the conditions under which the cotton plant is most susceptible to attack by bacterial disease (*B. (Pseudomonas) malvacearum*).

Typical angular leaf spot resulted after isolation and inoculation, and progressed in the way described by Smith (E. S. R., 48, p. 142). Similarly, boll rots were induced by inoculations of both blooms and young bolls. The black arm stage, however, seldom developed in the absence of stem puncture, as field conditions in Trinidad apparently do not generally favor these bacterial diseases.

Inoculation tests showed Egyptian (Sakel) and Sea Island to be quite susceptible. Trinidad Red Kidney cotton showed angular leaf spot. Upland varieties scarcely developed the disease. Asiatic varieties (Million Dollar and *Gossypium cernuum*) were completely resistant. As throughout this work, the development of the disease was considered predominantly from the point of view of the condition of the plant, the possibility of variations in the infecting organism was not completely covered. Reisolations occasionally made and tested showed no great variation in infective power.

While degrees of resistance appear definitely heritable, susceptibility and severity may be determined largely by external factors. From results of tests indicated on nitrogenous manuring and on ringing, and from the severity of the attack on the youngest leaves, it is thought that the vegetative nitrogenous immature type of plant is most liable to the disease. From this it is thought that early maturity would be an advantage.

The question as to the spread of the disease in the field is still open. The question as to the transmission within the seed is regarded as having been settled by Archibald (E. S. R., 61, p. 844).

It has not proved possible to destroy the organism within the seed by any means that will not at the same time injure or kill the seed.

Excessive soil moisture definitely favors the disease.

Further studies of cotton root rot in Arizona, with a description of a sclerotium stage of the fungus, C. J. KING and H. F. LOOMIS (*Jour. Agr. Research* [U. S.], 39 (1929), No. 9, pp. 641-676, figs. 17).—The discovery was recorded (E. S. R., 61, p. 745) in September, 1928, of apparently true types of sclerotia formed from mycelial strands extending through sand and soil in pure cultures. The production of the sclerotia was apparently influenced by temperature conditions, and, although not yet found in nature, it is deemed possible that sclerotia may play an important part in overwintering the fungus. In form the sclerotia were small, round or oval, tuberlike, attaining a diameter of from 1 to 2 mm., of rather firm texture, showing in section rather large, closely packed cells with one or more surface layers of smaller and harder cells of irregular form, a type of structure evidently adapted to survival through periods of inactivity and for resistance to changes in temperature and submergence in water, but not for desiccation in the air.

An extensive distribution of the root-rot mycelium on the roots of the date palm, Johnson grass, and Bermuda grass and the ability of the fungus to exist for months on the roots of these plants in cultures suggest that such plants may serve as carriers. Failure to culture the fungus on the fresh roots of citrus species is tentatively ascribed to the presence of some inhibiting substance which interferes with the growth of the mycelium. The discovery of live mycelium on decayed tree roots at a 6-ft. depth showed a wide functional range.

The advancing line of infection in alfalfa fields was effectively blocked by barriers of oil mixed with soil placed to a 3-ft. depth and also by sheets of galvanized iron. At Sacaton, Ariz., clean fallow maintained for two years did not reduce subsequent infection when replanted to cotton. A study of the growth in long glass tubes of sterile sand showed mycelial strands at a distance

of 2 ft. or more from the food supply. The elongation of the strands following the removal of the food supply suggests the capability of reutilizing nutrients to extend growth. Finding that secondary organisms retarded and sometimes stopped mycelial growth, it is suggested that other soil organisms may determine the distribution of the disease.

Studies of cotton root rot at Greenville, Tex., H. C. McNAMARA and D. R. Hooton (*U. S. Dept. Agr. Circ. 85* (1929), pp. 16, pls. 4, figs. 5).—Careful inspection over the 8-year period, 1920–1927, of infected areas on the field plots of the cotton-breeding station at Greenville, Tex., showed that the spread of the root rot infection was due to the expansion of the original areas rather than the development of new spots. Where cotton was grown continuously the infected areas increased about threefold in size in the 8 years. The disease apparently spread across rows at about the same rate as along the row, and no indication was seen that tillage practices spread the infection. In the circle of infection the border plants were usually the first to succumb.

Concerning the depth to which the organism penetrates the soil, active mycelium was found on cotton roots down to 26 in., but it is thought that the major infection occurs within the upper 15 in. The progress of the disease was stopped by a narrow trench 24 in. in depth, but a 12-in. excavation was not fully successful. Clean fallow over a 2-year period gave promising control results, but 1 year's fallow sufficed only to delay the onset of the disease. A combination of fallow and of nonsusceptible crops is believed promising.

The fruitage stage of the root rot fungus was apparently rarely attained at Greenville. In 1926, following a humid summer and fall, there was a heavy production of spores.

Observations on a fungus disease and an insect pest of cotton, H. K. Hewison and J. E. Symond (*Empire Cotton Growing Rev.*, 5 (1928), No. 1, pp. 48–53).—In the course of an investigation, the main purpose of which was a study of the growth and developmental responses to local conditions of the aboveground and underground portions in various types of cotton, observations were made on the incidence of *Alternaria* leaf spot (*A. longipedicellata*) and of the cotton-staining *Dysdercus*, two forms of which were observed (*D. howardi* and *D. howardi minor*).

Varietal resistance of soybean to the bacterial pustule disease, S. G. Lehman and J. W. Woodside (*Jour. Agr. Research [U. S.]*, 39 (1929), No. 10, pp. 795–805).—At the North Carolina Experiment Station two varieties of soybean, Lexington and Columbia, were found in one field test to be entirely free from the bacterial pustule disease. The Columbia variety was placed in the group showing high resistance in a greenhouse study embracing 40 varieties and selections. In another field test of 55 varieties, in which the plants were sprayed with suspensions of the disease, Columbia again demonstrated superior resistance, winning first place in this respect. Under laboratory conditions favorable to the development of the disease inoculated plants of the Columbia variety were infected, but the lesions were smaller and fewer in number and slower in development as compared with those of other resistant types. The numerous varieties tested are classified according to their resistance shown in the studies.

Observations on tassels of teosinte malformed by *Sclerospora*, W. H. Weston, Jr., and J. H. Craigie (*Jour. Agr. Research [U. S.]*, 39 (1929), No. 11, pp. 817–836, figs. 4).—Studies at the College of Agriculture of the Philippines upon the tassels of teosinte infected with downy mildew (*S. philippinensis*) showed the tassels to be greatly malformed and the female inflorescences suppressed altogether, so that the plants were completely sterile. Sterility was

accompanied by an unusually prolific vegetative growth, the continued and abundant production of new shoots showing some resemblance to the growth habit of perennial teosinte. In the case of tassels left lying on the ground during heavy rains, deformed spikelets comprising leafy shoots resembling seedling plantlets remained green and vigorous, grew upright, formed roots, and when transplanted lived independently for more than one week. Within their tissues the mycelium of the fungus remained alive and apparently capable of continued growth. Since such phenomena are unusual in the graminaceous tribe Maydeae and exceedingly rare in teosinte, they are described and illustrated.

Effects of soil temperature and reaction on growth of tobacco infected and uninfected with black root rot, W. L. DORAN (*Jour. Agr. Research* [U. S.], 39 (1929), No. 11, pp. 853-872, figs. 5).—Following earlier studies at the Massachusetts Experiment Station (E. S. R., 55, p. 450), in which it was found that black root rot did little or no damage to tobacco in a soil as acid as pH 5.6 and was severe at pH 5.9, the present paper discusses the joint effect of soil reaction and soil temperature on the disease. It was observed that the critical point for injury was decidedly influenced by temperature. At 15, 18, 21 and 24, and 27° C., marked injury began at pH 5.7, 5.7 or 5.8, 5.8, and 5.8 or 5.9, respectively. There was little or no injury at 30°, even with pH values of 6.0 to 6.9. The age of the plants was also a factor, the younger plants suffering most severely under like conditions. Soil reaction in the pH range 4.6 to 6.6 did not influence germination, and soil temperatures between 15 and 30° had less effect on the percentage than on the rate of germination.

The incubation period for the infection of tobacco seedlings was from 2 to 3 weeks under optimum conditions. Down to a minimum of 18° the lowering of the soil temperature and the approach to a nearly neutral soil reaction shortened the incubation period. In 1927 and 1928, cold and wet years, respectively, soil temperatures in a tobacco field near Amherst, Mass., remained generally below 24°, and with existing pH 6.0 resulted in severe losses.

Heavy liming decreased infection on susceptible strains as compared with unlimed plats, but resistant strains were not significantly influenced, suggesting that lime in itself was not directly harmful. On sterilized soil lime proved beneficial when soil temperatures were high, 27 and 30°, but retarded growth below 24°. Harmful effects of lime in the seed bed were relatively greater in soil disinfected with formaldehyde than in soil not thus treated.

Investigations on die-back of fruit trees.—I, A preliminary experiment and some field observations on *Diaporthe perniciosa* as a cause of "die-back" of plum trees, R. W. MARSH and R. M. NATTRASS (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt. 1927, pp. 93-98, pl. 1*).—In order to test the conclusions of Britton-Jones (E. S. R., 57, p. 53), the authors ringed or left unringed Czar plum trees worked on "compatible" and on "incompatible" stocks inoculated with *D. perniciosa* isolated from inner diseased tissue of a young plum showing typical die-back. The results, as tabulated, showed positive results from nearly all inoculations. Fructifications of *D. perniciosa* appeared on one or two of the cankers. Increase in size of the cankers, rapid at first, did not continue after the middle of October. These results are compared with those reported by Cayley (E. S. R., 52, p. 149), and details are given as to the results of examinations, also of field observations on die-back. Trees suffering from this are divided roughly into three groups, which are described in detail in connection with *D. perniciosa* and a few other fungi occasionally present.

The life history of the fire blight pathogen, *Bacillus amylovorus*, as related to the means of overwintering and dissemination, H. R. ROSEN

(*Arkansas Sta. Bul. 244* (1929), pp. 96, figs. 49).—Contrary to the popular conception that *B. amylovorus* winters over very largely on pears, the author found that apple, as well as pear, tissue was capable of carrying the organism through the winter. A cytological study of cortical stem infections showed invasion of the inner cortex, phloem, cambium, xylem, and pith, with the most serious injury resulting from the destruction of the cambium and phloem. Xylem invasion was frequently observed, the ducts being often occupied by masses of bacteria in various stages of growth. The production of suberized layers separating diseased and healthy areas in cortical tissues is described, but it is pointed out that the existence of well-defined, suberized, and cracked margins in cankers is no evidence of the lack of potential hazard. The depth of the infection as determined is considered evidence of the ineffectiveness of surface disinfection or scarification of cankers as a means of control. Cone-shaped areas of infection centering around old cankers on the pear and apple are held evidence of the rôle of cankers in overwintering the organism. No oozing from the cankers was noted in the field.

Concerning the relations between the pear and the apple, it was noted that years of severe pear blight were not necessarily those of severe apple blight or vice versa. Apple blight was found to be very severe in orchards more than 1.5 miles from any pear trees. Admitting the inherently greater susceptibility of the pear and the fact that badly diseased pears occurring among apples often increase blight injury, no evidence was secured that the pear is a necessary intermediate host. Among other plants harboring blight were the Burbank plum, the cultivated rose, Vanhoutte spirea, Japanese quince, *Amelanchier* sp., and *Crataegus* sp.

Spraying young pear and apple leaves and flowers with water containing the organism caused numerous infections, suggesting that insects are not necessarily the only carriers. Infections were thus produced on peduncles, receptacle walls, calyx lobes, and petals, the organism apparently entering through natural openings, such as the stomata. In the petals the bacteria progressed by their ability to dissolve cell walls and middle lamellae. Protoplasts were observed completely surrounded by bacteria, which evidently caused their death through asphyxiation. Wall materials served as an excellent source of energy for *B. amylovorus*. Studies of pear petioles showed much the same process of destruction as in the petals.

A biochemical note with respect to an apple tree affected by "silver leaf" disease, F. TUTIN (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt. 1927*, pp. 91, 92, pl. 1).—Observations regarding the deficiency of pectin in silvered apple leaves have been noted (*E. S. R.*, 57, p. 514). The present account deals with an apple tree variety, Keswick Codlin, on its own roots and of considerable age, which, when first observed in 1920, had one large branch bearing two smaller branches badly silvered, the rest of the tree appearing perfectly normal. In 1924, leaves collected from both sound and silvered parts of the tree showed deficient pectin in the latter. In that year the two smaller branches died. During the two following years the main branch on which these had grown, although continuing to crop well, decreased still further in vigor. In January, 1927, the two dead branches were cut off close up, and a few weeks later their center portions became covered with the fructifications of the silver-leaf fungus, *Stereum purpureum*, which, however, soon died. This appeared to end the silver-leaf condition in the tree. Subsequent leaves on that main branch were normal, as also was the new growth, the pectin content then appearing normal throughout the tree.

Legumes as rotation and trap crops for nematode control in pineapple fields, G. H. GODFREY (*Hawaii. Pineapple Cannery Sta. Bul. 10* (1928), pp. 21,

figs. 10).—The results are presented of a series of tests of a number of legumes for resistance to nematodes and for use as nematode trap crops. Among nematode resistant species the Iron and Brabham cowpeas developed galls to such an extent that neither is considered adaptable as a rotation cover crop for pineapples. The Laredo soybean was eliminated because of poor growth and susceptibility to insects. Among the velvet beans the Mauritius and the Florida varieties were immune to root knot and Japanese beetles. The pigeon pea showed much promise as a resistant legume, as did also *Crotalaria* and the jack bean.

Of legumes known to be highly susceptible to root knots and tested as trap crops, the cowpeas Groat, Taylor, New Era, and Whippoorwill are considered very suitable for this purpose.

General recommendations are given for the control of nematodes.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Principles of animal biology, A. F. SHULL (*New York: McGraw-Hill Book Co., 1929, 3. ed., [rev.], pp. XIV+405, pl. 1, figs. 266*).—This is a revised edition of the work by Shull, with the collaboration of G. R. Larue and A. G. Ruthven, previously noted (E. S. R., 52, p. 551).

The Mammalia: Introduction to the anatomy and classification of recent and fossil mammals, I, II, M. WEBER (*Die Säugetiere: Einführung in die Anatomie und Systematik der Recenten und Fossilen Mammalia. Jena: Gustav Fischer, 2. ed., 1927, vol. 1, pp. XV+444, figs. 316; 1928, vol. 2, pp. XXIV+898, figs. 573*).—The first volume of this work, prepared in collaboration with H. M. De Burlet, is devoted to anatomy and includes a classified bibliography of 20 pages and a subject index. The second volume, prepared in collaboration with O. Abel, is devoted to classification and includes a bibliography of 40 pages, arranged under 20 headings, and a subject index.

Life history and habits of grasshopper mice, genus *Onychomys*, V. BAILEY and C. C. SPERRY (*U. S. Dept. Agr., Tech. Bul. 145 (1929), pp. 20, pls. 4, fig. 1*).—In the first part, by Bailey, the general characters, general habits, breeding habits, economic status, and food habits are dealt with. The second part, by Sperry, dealing with laboratory studies of the food of *Onychomys*, reports upon analyses of stomach contents.

Laboratory examinations have shown that the animal kingdom contributes 88.87 per cent of the food of *Onychomys*. Insect food composed 79.28 per cent of the total food, 55.8 per cent is composed of grasshoppers, crickets, caterpillars, and moths, and 20.73 per cent of beetles. Cultivated grains comprised less than 5 per cent of the food and, as it consists mostly of wheat eaten in July, this was probably waste. According to this evidence the grasshopper mice should certainly be regarded as economically beneficial.

Control of rat damage in paddy fields, K. VENKATARAMAN (*Madras Agr. Dept. Yearbook 1928, pp. 23-29, pl. 1*).—The author deals with methods of combating rats in rice fields. This pest is a source of serious loss in Madras, where a single rat is commonly believed to account annually for 32 lbs. of grain.

Red-squill powders as raticides, J. C. MUNCH, J. SILVER, and E. E. HORN (*U. S. Dept. Agr., Tech. Bul. 134 (1929), pp. 36, pl. 1*).—The authors here report upon studies conducted, the details of which are presented in tabular form. It is pointed out that while powdered red squill is toxic to rats white squill is not. Powders prepared by directly drying unfermented, sliced red squill bulbs in an oven at 80° C. are usually more toxic than those prepared under other conditions. The lethal dose of squill powders prepared by this

method is usually about 250 mg. per kilogram of body weight for white rats; wild (brown) rats are killed by somewhat smaller doses.

Cats, dogs, chickens, and pigeons were not seriously harmed by squill powder. Food poisoned with squill either was not eaten or, if eaten was promptly vomited. Consequently, it has been indicated that red squill is nontoxic to these animals under normal conditions and when exposed in the concentration recommended for rat poisons.

The authors find that because of variations in toxicity, squill powders should be tested before being marketed and adjusted so that 10 gm. of 10 per cent squill bait will kill a minimum of 1 kg. of rat (1 oz. will kill 7 lbs. of rats).

A list is given of 20 references to the literature.

How to make a cat trap, J. SILVER and F. N. JARVIS (*U. S. Dept. Agr. Leaflet 50* (1929), pp. 4, fig. 1).—Directions are given for the construction of a trap for use in capturing stray cats.

The bird book, C. P. SHOFFNER (*New York: Richard Manson, 1929, pp. XI+335, pls. 65, figs. 2*).—Included in this practical work are more than 500 questions and answers.

Manual for bird banders, F. C. LINCOLN and S. P. BALDWIN (*U. S. Dept. Agr., Misc. Pub. 58* (1929), pp. 112, figs. 70).—Information for bird banders is here presented under the headings of traps for small-bird stations, nest traps, special traps and methods, traps for waterfowl stations, other trapping equipment, bait, operation of traps, handling captured birds, bands, records, and problems that trapping-station operators may solve. A list of references to the literature and a list of ornithological organizations are given in two appendices.

Game birds suitable for naturalizing in the United States, W. L. MCATEE (*U. S. Dept. Agr. Circ. 96* (1929), pp. 24, figs. 14).—This account, which follows a bulletin on Wild Birds Introduced or Transplanted in North America, by Phillips (*E. S. R.*, 59, p. 454), points out the possible dangers from importations and deals with success in naturalizing exotic game birds, sources of additional importations, species recommended, species considered undesirable, habitats for the species recommended, and suggestions as to methods of naturalizing game birds.

A guide to Colorado birds, W. H. BERGTOLD (*Denver: Smith-Brooks Ptg. Co., 1928, pp. 207, fig. 1*).—Included in this handbook are spring migration dates at five separate localities in the State, presented in tabular form, keys based on the striking characters, and a general key, followed by a descriptive list of Colorado birds (pp. 55-191), a glossary, and a bibliography of 7 pages.

The birds of Australia, XI, XII, G. M. MATHEWS (*London: H. F. & G. Witherby, 1923-24, vol. 11, pp. XIII+593, pls. 51; 1925-1927, vol. 12, pp. XII+454, pls. 59, figs. 3*).—These volumes, which deal with the order Passeriformes, conclude the work previously noted (*E. S. R.*, 51, p. 54).

The birds of Norfolk and Lord Howe Islands and the Australasian South Polar quadrant, with additions to "The Birds of Australia," G. M. MATHEWS (*London: H. F. & G. Witherby, 1928, pp. XII+[3]+139, pls. 45, fig. 1*).—Included in this work are additions to The Birds of Australia, above noted.

A practicum of protozoology, M. HARTMANN (*Praktikum der Protozoologie. Jena: Gustav Fischer, 1928, 5. ed., rev. and enl., p. VI+181, figs. 136*).—This is a fifth edition of the second part of Küsskalt and Hartmann's *Praktikum der Bacteriologie und Protozoologie* (*E. S. R.*, 46, p. 78).

Protozoology: A manual for medical men, J. G. THOMSON and A. ROBERTSON (*London: Baillière, Tindall & Co., 1929, pp. XIII+376, pls. 4, figs. 220*).—

This manual takes up the subject in 47 sections, the last 3 of which deal with technic (pp. 333-357), derivations and definitions (pp. 357-362), and references (pp. 362-365). Among the many subjects dealt with particular mention should be made of sections on coccidiosis (pp. 82-97), babesiasis or piroplasmosis (red water fever) (pp. 98-103), the trypanosomes of man and animals (pp. 235-258), trypanosomiasis—pathology (pp. 258-267), the sarcocysts (pp. 278-284), and rat-bite fever (pp. 330-333).

A guide to investigation of the intestinal Protozoa parasitic in man, F. W. BACH (*Leitfaden zur Untersuchung auf die Parasitischen Protozoen des Menschlichen Darm-Kanals*. Jena: Gustav Fischer, 1929, pp. IX+140, figs. 51).—The first part of this work deals with the intestinal Protozoa parasitic in man, and the second part with investigational technic. A list of 196 references to the literature is included.

On natural control, W. R. THOMPSON (*Parasitology*, 21 (1929), No. 3, pp. 269-281).—This is a general discussion of the subject considered in twelve parts.

Evolution of hydrocyanic acid from calcium cyanide, H. D. YOUNG (*Indus. and Engin. Chem.*, 21 (1929), No. 9, pp. 861-863, figs. 4).—The author finds that with any given calcium cyanide the rate of evolution of hydrocyanic acid increases with increasing relative humidity. With a calcium cyanide, 80 per cent of which will pass through a 200-mesh sieve, commercially satisfactory evolution of hydrocyanic acid (90 per cent or more) will occur in about two hours with a relative humidity of 50 per cent or more.

The preparation of a pyrethrum spray fluid, F. TUTIN (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.* 1928, pp. 96-102).—The author has found that the active principles present in pyrethrum flowers can be readily extracted by means of light petroleum. The extracted active principles, when dissolved in a fatty oil such as rape oil, may be emulsified conveniently by means of Agral WB. An emulsion prepared in this manner, representing a concentration of 1 per cent of the original flowers, when used as a spray is rapidly fatal to insects but causes no damage to vegetation.

The Long Ashton tar distillate wash: Field experiments, 1927-28, L. N. STANILAND and C. L. WALTON (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.* 1928, pp. 87-95, figs. 2).—Noted from another source (*E. S. R.*, 61, p. 356).

The uses of naphthalene for the control of certain pests of market gardens, L. N. STANILAND and C. L. WALTON (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.* 1928, pp. 103-105).—Satisfactory control of several insect pests of market gardens has been obtained by growers by the use of naphthalene.

[**Economic insects and their control in California**] (*Calif. Citrogr.*, 11 (1926), Nos. 8, pp. 296, 298, figs. 2; 10, pp. 396, 397; 12 (1927), Nos. 4, pp. 135, 147, 148; 6, p. 214, figs. 2; 7, p. 237; 8, pp. 271, 299, 302, 303, figs. 4; 9, pp. 308, 320, 321, 322, 323, 342, figs. 6; 10, pp. 348, 349, 360, 361, 364, 365, figs. 2; 12, pp. 431, 434).—Several papers relating to economic entomology not previously noted are as follows: New Material for Citrus Fumigation, by H. J. Quayle (pp. 296, 298), the first report of which, by F. J. Metzger, has been noted (*E. S. R.*, 55, p. 307); Recent Investigations of Resistant Red Scale, by R. S. Woglum and J. R. LaFollette (pp. 396, 397); Observations on Control of Citrus Insects by Overhead Irrigation, by J. R. LaFollette and W. E. Landon (pp. 135, 147, 148); Insect Pest Control Problems: Control of European Brown Snail, *Helix aspersa*, in Citrus Orchards, by A. J. Basinger (p. 214); Five Years of Vacuum Fumigation, by A. H. Call (p. 237); Citrus White Fly Campaign in California, by D. B. Mackie (pp. 271, 302, 303); Control of the Fire Ant, by W. R. Schoon-

over (p. 299); Citrus White Fly Campaign in California, Part II, by D. B. Mackie (pp. 308, 320, 321); Fumigators Discuss Problems of Pest Control Operations (pp. 322, 323); Summary of Orange Worm Investigations, by A. J. Basinger (p. 342); Control of Red Scale by Spraying and Fumigation, by R. S. Woglum (pp. 348, 364, 365); Fumigation and Spray Combination for Red Scale, by H. J. Quayle (pp. 349, 360, 361); and Orange County's Pest Control Work by Biological Methods Enlarged, by A. A. Brock (pp. 431, 434).

Insects of Indiana for 1928, J. J. DAVIS (*Ind. Acad. Sci. Proc.*, 44 (1928), pp. 299-314, figs. 9).—This is a summary of the more important insect pests of the year, arranged under the respective crops and products attacked.

[Report of the division of entomology of the New York State Station] (*New York State Sta. Rpt. 1929*, pp. 52-60).—This is a brief summary of the work of the year.

In continuation of control work with the pear psylla (*E. S. R.*, 58, p. 856), all lubricating oils tested in cold mix emulsions and the various commercial oil preparations proved effective in reducing the number of adults and rendering trees uncongenial to them. It is pointed out that in most orchards the use of oil sprays is recommended for not more than two successive seasons, after which recourse should be had for a season or two to nicotine sprays.

Further investigations of the cherry maggot (*E. S. R.*, 58, p. 856) have shown that infestation of cherry fruits may be markedly reduced by timely applications of arsenical sprays and dust mixtures.

In studies of the carrot rust fly, which continues to take a large toll from growers, it was found that carrots planted after the first of June ordinarily escape damage, and that if such late-planted carrots are harvested by the first to the middle of September they should be exempt from serious injury.

Experiments extending over a period of three years in cooperation with growers indicate that lubricating oil emulsion is an efficient and economical treatment for combating the onion maggot.

The oriental peach moth (*Laspeyresia molesta*) is said to be firmly established in Niagara and Chautauqua Counties in western New York. The importation of the larval parasite *Macrocentrus ancylivora* was made from New Jersey. The egg parasite *Trichogramma minutum* is being reared in the laboratory, and liberations will be made throughout the season.

Of the materials tested to prevent injury by the cabbage maggot, mercuric bichloride solutions 1:1,200 gave the best results. A dry application of Bayer Special No. 190 and sand in proportions by weight of 1 to 10 gave the second best results.

Notes on grape insects, the European corn borer, cucumber insects, potato insects, and fruit insects in the Hudson River valley are also included.

[Contributions on economic insects] (*Ztschr. Angew. Ent.*, 14 (1928), No. 2, pp. 229-415, figs. 50; 14 (1929), No. 3, pp. 417-606, figs. 56; 15 (1929), No. 1, pp. 1-206, figs. 79).—The papers presented in the first of these three issues (No. 2) relating to insects of economic importance (*E. S. R.*, 61, p. 753) include the following: On the Knowledge of the Biology of the Ant *Camponotus herculeanus* L., by H. Eidmann (pp. 229-253); Conditions Governing Outbreaks of Insects, by H. Bremer (pp. 254-272); On the Chain Line and Exponential Curve in General as Examples of the Influence of Warmth on the Duration of Development, by E. Martini (pp. 273-284); Experiments with Calcium Cyanide in Combating Greenhouse Pests, by Hülseberg (pp. 285-315); The Present Status of the Use of Hydrocyanic Acid in the Control of Pests, by W. Rasch (pp. 316-324); Experiments on Practical Fly and Mosquito Control, by W. von Schuckmann

(pp. 325-342); A Contribution to the Knowledge of *Marseulia dilativentris* Reiche (Col. Chrysom.), by F. S. Bodenheimer and H. Z. Klein (pp. 343-355); On the Classification of the Stomoxinae (Blood Sucking Muscids) and New Species from Europe and Africa, by G. Enderlein (pp. 356-368); and A Study of *Pollenia hasei*, by E. Séguin (pp. 369-375). Among the brief contributions, a number of which follow, is one on *Olytus lama* Muls. (Cerambycidae), A Little Known Pest of Coniferous Timber, by E. Schimitschek (pp. 384-388); An Outbreak of *Hylotrupes bajulus* L. in Lübeck, by Steyer (pp. 388, 389); Investigations of the Nutrition Physiology of Lepidoptera (pp. 389, 390); and A Scheme which Illustrates the Life of Plant Lice, by M. Dingler (pp. 390-393).

The papers presented in No. 3 include the following: Contributions to the Anatomy of *Niptus hololeucus* Fald., by B. A. Marcus (pp. 417-449); On the Biology and Damage of *Ptinus tectus* Boield., by H. v. Lengerken (pp. 450-460); On the Knowledge of the Life Histories of the Giant Cockroach, *Blaberus fusca* Brun., and the Surinam Rouch, *Pycnoscelus surinamensis* L., by R. Saupe (pp. 461-500); On Nosematosis of *Antheraea pernyi* Guér., by D. L. van der Flaas (pp. 501-513); Experimental Biological Studies of Wireworms, by Flachs (pp. 514-523), which includes a bibliography of 131 titles; The Occurrence of *Eulia* (*Tortrix*) *politana* Hw. on Pine Seedlings, by A. F. von Vietinghoff-Riesch (pp. 529-537); Observations on G. Wellenstein's Contributions to the Biology of the Red Forest Ant [*Formica rufa*], by E. Wasmann (pp. 538, 539); and The Outbreaks of Insect Pests in German Forests: A List of the Literature for the Years 1449-1926, by F. Ritter (pp. 540-583).

The third issue (No. 1) takes up the following: Morphological and Physiological Investigations of the Female Reproductive Organs of Lepidoptera—I, Morphology, by H. Eidmann (pp. 1-86), which includes a 3-page bibliography; On the Possibilities of Biological Control of *Pseudococcus citri* Risso (Rhy. Cocc.) in Palestine: An Epidemiological Study, by F. S. Bodenheimer and M. Guttfeld (pp. 67-136); The Poisoning of *Bupalus piniarius* L. in the Forestry Division of Hersfeld-Ost in 1926, by L. Rhumbler (pp. 137-158); The Granary Weevil in Stored Grain, by R. Kleine (pp. 159-164); The Effect of Some Nonpoisonous Sprays on Insects, by Stoher (pp. 165-169); The Results of Three Years' Activity of the Hydrobiological Division in the Investigation of the Ecology of Anopheles Larvae at the Peat Production Station, by A. N. Adowa and B. M. Sebenzow (pp. 170-177), which includes a list of 22 references to the literature; On the Biology of *Chimabache jagella* F., by V. v. Butovitsch (pp. 178-180); and Insects as Transmitters of Plant Diseases, by K. Böning (pp. 181-206), which includes a bibliography of 269 titles.

- List of entomological publications of personnel of Cereal and Forage Insect Investigations, U. S. Bureau of Entomology, 1904-1928, inclusive, compiled by J. S. WADE (U. S. Dept. Agr., Bur. Ent., [1929], pp. 46).—This is a list of the entomological publications of the division issued from 1904 to 1928, inclusive.

Some insect pests of *Vigna hosei* and *Calopogonium mucunoides* [trans. title], P. VAN DER GOOT (*Landbouw [Buitenzorg]*, 4 (1929), No. 12, pp. 753-768, pls. 4; *Eng. abs.*, pp. 767, 768; also in *Dept. Landb., Nijv. en Handel [Dutch East Indies]*, *Korte Meded. Inst. Plantenziekten*, No. 11 (1929), pp. 16, pls. 4; *Eng. abs.*, pp. 15, 16).—This deals with the insect enemies of two creeping green manure plants extensively grown in the Dutch East Indies. The *Vigna* bug *Ochauliops bisontula* Banks and the flea beetle *Halticus tibialis* Reut. are said to be the most important.

Vegetable garden insects, G. F. MACLEOD (*Penn. State Col. Ext. Circ.* 122 (1929), pp. 31, figs. 11).—A practical account of the insect enemies of the garden and means for their control.

Handbook of citrus insect control for 1929, R. S. WOGLUM, J. R. LAFOLETTE, and W. E. LANDON (*Calif. Fruit Growers Eeach., Los Angeles, Bul. 6* (1929), pp. [2]+48, pls. 3, figs. 12).—Included in this 1929 edition (E. S. R., 59, p. 855) is a report of work in central California by E. A. McGregor (pp. 26-28) and of the Mediterranean fruit fly by R. S. Woglum (pp. 33-48).

Annual report of the Government entomologist, H. HARGREAVES (*Uganda Dept. Agr. Ann. Rpt. 1928*, pp. 44, 45).—This brief account of the work of the year deals particularly with insect enemies of coffee.

The insect enemies of the cork oak in the forests of Morocco.—Second study [trans. title], J. DE LÉPINEY (*Min. Agr. [France], Ann. Epiphyties, 14* (1928), No. 4, pp. 313-321, fig. 1).—This second report (E. S. R., 59, p. 154) of a study of the enemies of the cork oak in Morocco deals with 14 pests, particular attention being given to the gipsy moth. Instructions are given for the rearing and release of *Schedius kuvanae*, parasite of the gipsy moth.

Field book of destructive forest insects (*Augusta, Me.: Kennebec Valley Protect. Assoc. and Maine Forest Serv., 1929*, pp. [2]+20+[2], figs. 45).—A brief pocket guide.

Locust sub-committee: First and second interim reports, H. A. MIERS ET AL. (*London: [Gt. Brit.] Com. Civil Research, 1929*, pp. 14).—The first and second interim reports of a subcommittee of the Committee of Civil Research appointed in April, 1929, are here presented.

Some results of an investigation on the biology of Myzus persicae Sulzer [trans. title], J. K. DE JONG (*Bul. Deli Proefsta. Medan, No. 28* (1929), pp. 36; *Eng. abs.*, p. 33).—This is a report of studies of the life history and bionomics of an aphid enemy of tobacco conducted at the Deli Experiment Station in Sumatra, where only females are known and these propagate parthenogenetically.

A preliminary account of the raspberry aphids, J. D. WINTER (*Minnesota Sta. Tech. Bul. 61* (1929), pp. 30, figs. 3).—An account is given of the aphids recorded on *Rubus* in North America and in Europe, including their synonymy and host plants, with notes on the biology and morphology of the three species of aphids common in Minnesota, *Amphorophora rubi* (Kalt.), *A. rubicola* (Oest.), and *Aphis rubicola* Oest.

Five species are found widely distributed in North America, and five additional species are recorded, two of which are of questionable records. Six species are found in Europe, and six others are recorded under circumstances indicating that the bramble fruits are not their normal hosts. It is pointed out that only one species is common to both North America and Europe.

Eggs of *A. rubi* and *Aphis rubicola* have been collected, and these two species have been followed on the raspberry throughout the year. In a study made of the distribution and movement of wingless forms of *A. rubi*, it was found that this aphid may be carried on the clothes of persons from one raspberry planting to another and that distribution occurs within a planting when the foliage is distributed by cultural operations and by digging of plants.

The Herbert variety exhibited a very marked resistance to *A. rubi*. Under favorable conditions, with its insect enemies removed, *A. rubi* will feed and live on the Herbert variety for several weeks, but is unable to maintain its population. The population on check plants of other varieties invariably increased, often at a rapid rate. Under field conditions it seemed unable to exist on Herbert in the plantings where observations were made for two years, although many were found on other varieties growing in adjoining rows. The proboscis of this aphid is inserted with apparent ease in the leaves of the Herbert variety, indicating that thickness of cuticle is not a limiting factor.

The cotton white-fly (*Bemisia gossypiperda* n. sp.), C. S. MISRA and K. S. LAMBA (*Agr. Research Inst., Pusa, Bul. 196 (1929), pp. 7, pls. 2*).—This is an account of a new species observed for the first time on cotton in Bihar in the year 1905. Then as now it was observed to be present more frequently on the broad-leaved varieties of cotton than on the short-leaved ones. It has not as yet become a pest.

Observations on the Coccidae of Formosa, I, R. TAKAHASHI (*Formosa [Taiwan] Govt. Research Inst., Dept. Agr. Rpt. 40 (1929), pp. 82+3, figs. 38*).—Following an introduction, a food plant catalogue of the Formosan Coccidae (pp. 5–28) is given. The distribution and local abundance of the Coccidae in Formosa and Coccidae associated with *Cremastogaster rogenhoferi* Mayr. in Formosa are then taken up (pp. 28–31). An annotated list is given of Formosan Coccidae (pp. 31–82), with descriptions of one new genus and seven new species.

Notes on the butterflies of British Honduras, F. L. DAVIS (*London: Old Royalty Book Pub., 1928, pp. 101, pl. 1*).—This is a report of observations extending over a period of more than 30 years in various districts of British Honduras.

Studies on the relation of blood constituents and flacherie in silkworms, O. FUJII (*Bul. Agr. Chem. Soc. Japan, 2 (1926), No. 5, pp. 58–60*).—The author is led to conclude that infection with bacteria alone can not be the cause of flacherie, but that disturbances in the digestive tract must first occur and lead to the rapid multiplication of bacteria in the intestinal canal and blood.

The clover-leaf caterpillar (*Olethreutes cespitana* Hübner) and the clover-leaf tyer (*Anchylopera angulifasciana* Zeller), L. P. WHEELER (*New York Cornell Sta. Bul. 489 (1929), pp. 27, figs. 19*).—*O. cespitana*, first dealt with (pp. 3–15), passes through two generations in the vicinity of Ithaca, N. Y. It was found that the flight of moths of the first generation extends throughout the month of June, and that those of the second generation are in flight in the field during the month of August. The length of the egg stage of the first generation is about 10.16 days and of the second generation about 8.03 days, of the larval stage of the first generation about 26 days and of the second generation about 293.33 days, of the pupal stage of the first generation about 13 days and of the second generation about 16 days. The caterpillar fastens the leaflets together with silk and feeds within the shelter thus formed. It eats irregular holes through the leaflets or elongated holes between the veinlets of the leaflets. The overwintering cocoon, which is made of white silk and within which the larva hibernates, is formed between the leaflets which are tied together with silk. The number of instars in one individual studied was found to be five.

There were found to be two generations of *A. angulifasciana* each year in the vicinity of Ithaca. The moths of the first generation are in flight in the field from about the middle or latter part of May until about the middle of June and those of the second generation from late July until late August or early September. The length of the egg stage of the first generation is about 10.11 days, of the second generation about 8 days; that of the larval stage of the first generation is about 19.75 days and of the pupal stage about 11 days. The newly hatched larva feeds on the underside of the leaflet along the side of the midrib, under a thin web of silk. Later it ties the leaflet or leaflets together with silk and feeds within the shelter thus formed. The larva eats out the green part of the leaflet between the branches of the veins, leaving the thin, light-colored layer on the outside. The winter is passed in a shelter formed by leaflets of clover tied together with silk.

Lists of references to the literature on both species are included.

Pink bollworm (*Platyedra gossypiella* Saunders) in the Gezira district of the Sudan in 1927 and 1928, H. B. JOHNSTON (*Wellcome Trop. Research Labs., Ent. Sect. Bul.* 26 (1929), pp. 27, pls. 2).—This is an account of observations during 1927 and 1928, in which years there was an increased rate of infestation by the pink bollworm in the Gezira cotton crop, the average being 3.8 per cent in 1927 and 24.1 per cent in 1928.

Additional information on controlling codling moth by spraying and dusting, R. H. SMITH (*Diamond Walnut News*, 11 (1929), No. 1, pp. 8, 9).—The observation made in the spring of 1927 by F. B. McLane that young larvae are often found outside of the burrows in the morning led to those here contributed from the California Citrus Experiment Station by the author and A. W. Lopez. The most striking behavior observed during the period from May 24 to about July 1 was the tendency of the larvae to linger after hatching instead of directly burrowing into the nuts, several days often elapsing. A summary of the observation of their behavior at Carpinteria, reported in tabular form, has shown that up to July 1 a considerable percentage of the larvae was either partially or entirely out of the burrows throughout the day, and the largest percentage was out during the earlier part of the forenoon. It appears that the hatching of the first brood of larvae usually extends over a period of about two months and is more or less uneven, depending on the duration and intensity of warm spells of weather, especially in coastal counties.

The results of spray and dust applications for control after the larvae had hatched are reported upon in tabular form. It was found that the nicotine spray and dust as applied in the experimental tests were more effective than lead arsenate spray and dust. The dust applications were more thorough than the average commercial treatment, which fact is thought to account in part for the comparatively poor results of the combined nicotine and lead arsenate dust. The nicotine spray seemed to be more effective than the nicotine dust. However, applied at the rate of 0.75 pint of nicotine sulfate to 100 gal. of water more nicotine per tree was applied by the spray than by the dust. The nicotine spray used with fish-oil soap as a spreader appeared less effective than when used with a caseinate spreader, although this requires further investigation. The time of spraying must be gauged according to the size of the nuts as well as by the hatching of the larvae.

Notes on the life-history of *Cydia* (*Carpocapsa*) *pomonella* L., R. ADKIN (*Soc. London Ent. and Nat. Hist. Soc. Proc.*, 1928-29, pp. 24-29, pl. 1).—The author points out that while considerable doubt has been expressed as to the codling moth ever being double brooded in Great Britain there is abundant evidence that in favorable seasons a very considerable second brood may occur.

The corn borer in central Europe: A review of investigations from 1924 to 1927, K. W. BABCOCK and A. M. VANCE (*U. S. Dept. Agr., Tech. Bul.* 135 (1929), pp. 55, pls. 10, figs. 3).—This is a review of investigations conducted from 1924 to 1927, reported under the headings of distribution surveys, the central European plains, the corn borer as a native of the central European plains, natural enemies, and control.

The variations in seasonal development and intensity of infestation by the European corn borer in central Europe are attributable to fluctuations of factors in the environment. The authors failed to find any climatic or cultural reasons why the distribution of the European corn borer should not extend to all points in the main corn-growing regions of the United States. The practice of clean culture, following a program which includes all possible means of reducing the borer population, is an essential feature of control. In general, the areas

of comparatively clean culture suffer less from the ravages of the borer than do the regions where clean-up practices are not followed. In one-generation areas heavy infestations may occur in crops other than corn, and in weeds as well. The widespread distribution and local effectiveness of certain species of parasites of the corn borer occasion hope that parasites may be effective in aiding the program of control in North America. All types of corn may be severely damaged by the corn borer, as no variety or type was observed which was practically immune. The elimination of very susceptible varieties of corn and a proper regard for the most favorable date of planting appear to be two of the promising possibilities for control.

A key to certain tortricid larvae occurring in Nova Scotia, with notes on their habits and life-histories, F. C. GILLIAT (*Sci. Agr.*, 10 (1929), No. 2, pp. 120-127, figs. 17).—This deals with species of tortricids belonging to a group known popularly as bud moths or leaf rollers, now well distributed over the entire fruit-growing section of the Annapolis Valley and in many districts orchard pests of importance.

Dried fruit grubs—the ethylene dichloride-carbon tetrachloride fumigation process, J. E. THOMAS (*Jour. Council Sci. and Indus. Research [Aust.]*, 2 (1929), No. 3, pp. 128-133).—The author finds that ethylene dichloride 3 parts and carbon tetrachloride 1 part by volume, when used at the rate of 14 lbs. per 1,000 cu. ft. at temperatures above 70° F. for a period of not less than 22 hours in perfectly air-tight compartments, practically sterilizes dried fruit in so far as infestation with the Indian-meal moth is concerned.

Antitoxic immunity in caterpillars of *Galleria mellonella* [trans. title], V. CHORINE (*Ann. Inst. Pasteur*, 43 (1929), No. 7, pp. 955-958).—The author finds that caterpillars of the wax moth can be immunized against the diphtheria toxin, this immunity being due to the elaboration of a substance which neutralizes the toxin, analogous to the antitoxin of mammals.

A list of the generic names used for microlepidoptera, T. B. FLETCHER (*India Dept. Agr. Mem., Ent. Ser.*, 11 (1929), pp. IX+244).—A total of 2,031 genera are listed.

The use of stearates (calcium and aluminum) as diluents for Paris green in *Anopheles* control.—A preliminary report, A. F. DOLLOFF (*Pub. Health Rpts. [U. S.]*, 44 (1929), No. 43, pp. 2588-2594).—The author's study indicates that the stearates of calcium and aluminum, when substituted for hydrated lime in the dilution of Paris green, prolong the period from the time of dusting to the reappearance of anopheline larvae from an average of three days to an average of between five and six days.

Notes on the breeding habits of *Culex fatigans* Wied. and its associated mosquitoes in Queensland, R. HAMLYN-HARRIS (*Roy. Soc. Queensland Proc.*, 49 (1928), pp. 91-103, pls. 2).—This mosquito is found associated with no less than nine different species in the Greater Brisbane area, the association depending to a very large extent upon the state of the water at the time of selection.

Zoological contributions to the surra problem.—XXIV, Some further transmission experiments with mosquitoes [trans. title]. O. NIESCHULZ (*Centbl. Bakt. [etc.]*, 1. Abt., Orig., 111 (1929), No. 6-8, pp. 456-460; abs. in *Rev. Appl. Ent.*, 17 (1929), Ser. B. No. 9, p. 177).—In further transmission experiments in Java (E. S. R., 61, p. 660), one direct transmission of surra from horse to horse was obtained with *Armigeres obturbans* Walk. Negative results were obtained from experiments with the yellow-fever mosquito and *Culex whitmorei* Gil.

On the so-called "daily turnover" of the anopheline population in resting-places and its bearing on the evaluation of the anopheline inci-

dence to test the effect of antilarval measures, N. H. SWELLENGREBEL and W. H. DOORNBOS (*K. Akad. Wetensch. Amsterdam, Proc.*, 32 (1929), No. 5, pp. 669-678, figs. 2).—This is a report of observations made in connection with studies previously noted (E. S. R., 62, p. 249).

On anophelism without malaria around Amsterdam (third communication).—On the food of adult *Anopheles maculipennis* in malarious and non-malarious regions, N. H. SWELLENGREBEL, A. DE BUCK, and E. SCHOUTE (*K. Akad. Wetensch. Amsterdam, Proc.*, 32 (1929), No. 6, pp. 772-779).—This is a report of observations conducted in continuation of those previously noted (E. S. R., 60, p. 561).

The reproductive system of the warble fly *Hypoderma bovis* DeGeer, D. C. MOTE (*Ann. Ent. Soc. Amer.*, 22 (1929), No. 1, pp. 70-80, figs. 18).—This is a contribution from the Oregon Experiment Station.

The injury to nestling birds by the larvae of *Protocalliphora*, C. W. JOHNSON (*Ann. Ent. Soc. Amer.*, 22 (1929), No. 1, pp. 131-135).—The literature relating to parasitism by bloodsucking dipterous larvae of the genus *Protocalliphora* is reviewed in connection with a bibliography of 12 titles, and observations made in New England are recorded. The data show that the larvae of *Protocalliphora* are a serious menace to nestling birds, and that measures should be taken to check their depredations.

The Mediterranean fruit fly, P. H. ROLFS (*Fla. Ent.*, 13 (1929), No. 2, pp. 25-30).—This contribution deals particularly with the occurrence of the Mediterranean fruit fly in the State of Minas Geraes, Brazil.

The walnut husk fly: Life history and possible control, A. M. BOYCE (*Diamond Walnut News*, 11 (1929), No. 1, pp. 15, 19, figs. 2).—This is a preliminary contribution from the California Citrus Experiment Station on the life history and possible control of the walnut husk fly, represented by several forms, of which *Rhagoletis juglandis* appears to be the most important. *Eusesta notata* and *Lonchaea occidentalis* are most commonly found of several species of scavenger flies that work in the infested nuts.

The Mexican bean beetle in Delaware, H. L. DOZIER (*Del. Univ., Agr. Ext. Circ.* 25 (1929), pp. 7, figs. 6).—This is a brief practical account of the beetle and control measures in Delaware, where it was discovered in the early summer of 1928. At the end of the season it was widely scattered over the entire State.

The Mexican bean beetle in Utah, V. M. TANNER (*Pan-Pacific Ent.*, 5 (1929), No. 4, pp. 183-186).—This pest is said to have been first observed by the bean growers of Springdale and Rockville in Washington County about 1919, and first reported as a pest in 1921. Examinations made by the author at that time showed about one-fourth of the bean crop to have been destroyed. The Virgin River and Santa Clara Creek areas in Washington County and Moab on the Colorado River in Grand County are said to be the only areas in the State known to be infested by the pest in January, 1929.

Notes on the life-history and habits of *Parasierola* sp., the bethylid parasite of *Nephantis serinopa*, Y. RAMACHANDRA and M. C. CHERIAN (*Madras Agr. Dept. Yearbook* 1927, pp. 11-22, pl. 1).—This is a report of biological studies of a species of *Parasierola* that has become of considerable importance in south India because of its part in the parasite complex that is bringing about the natural control of the blackheaded caterpillar of coconut (*N. serinopa*).

A pathological feature of flea-beetle injury of potato tubers, H. C. MACMILLAN and L. A. SCHAAL (*Jour. Agr. Research [U. S.]*, 39 (1929), No. 11, pp. 807-815, figs. 4).—This is a report of studies conducted in the Greeley area

of Colorado, where the potato flea beetle has long damaged potatoes. The foliage is eaten by the adult beetles, and the damage caused by the larvae when feeding on the growing tubers has been a direct cause of economic loss.

The damage caused by the larvae is of two kinds. The tuber surface is marred by the so-called worm tracks, and the places at which the larvae burrow into the flesh develop pimples. In the tuber flesh beneath the pimples are cores or slivers, which are found when the tuber is pared. The feeding of the larvae on the tuber, either in the portion appearing as tracks or at the point of burrowing, makes thin spots in the periderm, favorable to the entrance and infection of the scab organism (*Actinomyces scabies*). If the seed potatoes have been suitably treated with mercury compounds, this organism usually does not infect the larvae-injured potatoes, and the tubers from treated seed, while attacked by the larvae as severely as tubers grown from untreated seed, show relatively little surface eruption or pimples. They are clean, bright, and smooth.

A list is given of 14 references to the literature.

The parasites of wireworms (Coleop.: Elateridae), C. A. THOMAS (*Ent. News*, 40 (1929), No. 9, pp. 287-293, fig. 1).—This contribution from the Pennsylvania Experiment Station reviews the literature in connection with a list of 31 titles.

Biology of the Mexican cotton boll weevil, III, IV, E. F. GROSSMAN (*Fla. Ent.*, 13 (1929), Nos. 2, pp. 32, 33; 3, pp. 41-43).—The third part of the studies previously noted (E. S. R., 61, pp. 556, 856) deals with the mechanism of grub feeding, and the fourth part with the duration of fertility after copulation.

Observations on the rice-weevil, *Calandra oryzae*, S. HÔZAWA (*Annot. Zool. Japon.*, 12 (1929), No. 1, pp. 25-37, figs. 8).—The author deals with the life history of this weevil, including some peculiar features observed in studies at the Biological Institute of Tôhoku Imperial University, Sendai, Japan.

The control of red weevil (*Rhyncophorus ferrugineus* F.) in coconut palms, W. R. C. PAUL (*Trop. Agr. [Ceylon]*, 73 (1929), No. 3, pp. 131-135, pl. 1).—Control measures for this enemy of the stems of young coconut palms include treatment of young palms by surgical means, the adoption of preventive measures, and the use of traps. It was found that an effective reduction in the occurrence of the pest can be gained by the use of traps.

Report of the Dominion apiarist, C. B. GOODERHAM (*Canada Expt. Farms. Bee Div. Rpt. 1928*, pp. 23, figs. 5).—This is the annual report on the work of the bee division of the Canadian Department of Agriculture (E. S. R., 61, p. 453). Following general notes it deals with honey production at Ottawa and at the out-apiary, bees and pollination, queen breeding, the two-queen system, Carniolan v. Italian bees, package bees as a means of strengthening weak colonies in the spring, hives, field bees, top entrance, wintering case with upper entrances, brood count, disease, wintering, honey inspection, classification and grading of honey, establishment of color standards, liquid honey classes, granulated honey classes, and experiment on the effect of temperature and humidity on the storage of honey.

The practical bee guide, J. G. DIGGES (*London: Simpkin, Marshall, Hamilton, Kent & Co.*, 1928, 6 ed., [rev.], pp. VI+306, pl. 1, figs. [194]).—This work deals with the history, anatomy, appliances, and management.

Control of bee diseases and pests, F. B. PADDOCK (*Iowa Agr. Col. Ext. Bul.* 154 (1929), pp. 23, figs. 5).—A practical account.

It pays to protect bees in winter, R. H. KELTY (*Mich. Sta. Quart. Bul.*, 12 (1929), No. 2, pp. 35-37).—A practical account, in which it is pointed out that windbreaks for apiaries and insulation for colonies are needed in Michigan.

The known parasites of the American species of *Diatraea* (Lepidoptera, *Pyralidae*) [trans. title], H. E. BOX (*Bol. Estac. Erpt. Agr. Tucumán*, No. 5 (1927), pp. 9, pls. 5).—The author lists 37 forms as parasitic on moth borers of the genus *Diatraea*, with their distribution, hosts, and observations.

X-rays and parasitic wasps, P. W. WHITING (*Jour. Heredity*, 20 (1929), No. 6, pp. 263-276, figs. 3).—The author finds that there is but little if any effect of X-raying on the duration of life or general vitality of the parasitic wasp, *Habrobracon juglandis* (Ashm.). Females are sterilized but produce a few offspring immediately after treatment, probably because mature eggs are relatively resistant.

Life-history notes on *Microbracon serinopae* Ramkr., a parasite on *Nephantis serinopa*, M. C. CHERIAN (*Madras Agr. Dept. Yearbook* 1928, pp. 12-22, pl. 1).—The author reports observations made in the insectary at Coimbatore of the life history and habits of this parasite of the coconut caterpillar.

A leafhopper parasite, *Polynema saga* (Girault), P. B. LAWSON (*Ann. Ent. Soc. Amer.*, 22 (1929), No. 1, p. 130).—The author reports having found the eggs of *Euscelis stactogalus*, a leafhopper that was unusually abundant on tamarix bushes near the laboratory, University of Kansas, during the summer of 1927, to be highly parasitized by *P. saga*. This parasite, described by A. B. Gahan from a single specimen collected in Washington, D. C., in 1905, was found to have parasitized over 90 per cent of the overwintering eggs on the bushes examined.

Combating mites on Hevea nurseries [trans. title]. I. H. GONGGRIJP (*Meded. Alg. Proefsta. Alg. Ver. Rubberplanters Oostkust Sumatra, Rubber Ser.*, No. 67 (1929), pp. 19, figs. 3; *Eng. trans.*, pp. 12-19).—In comparative experiments with sulfur, Akar-Toeba, and Neoton the best and quickest results were obtained from the application of sulfur, and at a cost from one-third to one-fourth of that of the other materials.

ANIMAL PRODUCTION

The copper content of feedingstuffs, C. A. ELVEHJEM and E. B. HART (*Jour. Biol. Chem.*, 82 (1929), No. 2, pp. 473-477).—The copper content of 47 common feeding stuffs is given in this article from the Wisconsin Experiment Station, with the cooperation of H. E. Howe. Some of the manufactured feeds are unusually high in copper, probably due to contamination during the process of manufacture. Seeds and seed products were highest in copper, followed in descending order by hays and grasses and straws and stovers. Within certain limits the copper content of a crop could be increased by the use of copper salts as fertilizers.

The vitamin and mineral content of pineapple bran, C. D. MILLER (*Hawaii. Pineapple Cannery Sta. Bul.* 6 (1926), pp. 11, figs. 6).—Studies with rats fed from weaning time have shown that pineapple bran is a good source of vitamin B, being slightly lower in this respect than whole wheat. The vitamin A content was found to be remarkably high when it is considered that the bran is subjected to a heating and drying process. Compared with the grains, pineapple bran is probably pound for pound five or six times as good a source of vitamin A as the grains.

The results of analyses of three different samples of pineapple bran, two of which were made by the University of Hawaii laboratories and one by the

Hawaiian Sugar Planters' Experiment Station. are given in tabular form. The ash of the bran was analyzed for calcium, phosphorus, and iron only. The high iron content present was attributed in a large degree to fine soil clinging to the outside of the fruit. As compared with barley and wheat bran, pineapple bran is higher in calcium and iron.

Feeding value of alfalfa hay is variable, C. F. HUFFMAN (*Michigan Sta. Quart. Bul.*, 12 (1929), No. 2, pp. 37-39).—By means of tables the author points out variations in the composition of different samples of alfalfa hay, variations due to cutting at different stages of maturity, the relative composition of the hay, leaves, and stems, and the losses of nutrients resulting from exposing the hay to rain. A short discussion is also presented on the variation in the calcium and phosphorus content of different samples of hay.

Protein supplements decrease feeding costs, G. A. BROWN (*Michigan Sta. Quart. Bul.*, 12 (1929), No. 2, pp. 40-42).—In this article the value of protein supplements for rations containing corn and barley when fed to hogs, lambs, and calves is discussed.

The influence of diet on the body fat of the white rat, H. C. ECKSTEIN (*Jour. Biol. Chem.*, 81 (1929), No. 3, pp. 613-628).—In this study the author used white rats weighing approximately 40 gm. The animals were fasted for 48 hours, and then divided into two groups and placed on selected diets for a period of eight weeks. One group received diets free from preformed fat, while the other group received diets containing preformed fat. At the end of the feeding period the rats were killed and the bodies divided into several parts, from which the total lipids were extracted and analyzed.

The lipids obtained from the animals on the several diets were similar in all respects. A definite change in the nature of the lipids occurred, however, when myristic acid, triolein, and sodium butyrate were incorporated in the diet. The butyryl radical was apparently not deposited in the tissues, while the other two were. Arachidonic and linoleic acids were always present in the tissues, and while the contents of the total lipids were found to vary considerably with the diets the amount of the more highly unsaturated acids was appreciably altered only by the feeding of triolein. The percentage of cholesterol was found to be constant and independent of the diet.

Calcium and magnesium relations in the animal, W. P. ELMSLIE and H. STEENBOCK (*Jour. Biol. Chem.*, 82 (1929), No. 3, pp. 611-632, fig. 1).—In order to study the effect of the ingestion of magnesium salts on the assimilation of calcium, the Wisconsin Experiment Station fed varying amounts of these salts to rats. The ash content and mass of the bones and growth in body weight were used to measure the effect.

The results showed that excessive amounts of magnesium salts reduced the palatability, lowered the food intake, and was accompanied by such severe digestive disturbances that any effect was masked. Lesser, but still relatively large, amounts of magnesium did not cause the above disturbances. Under these conditions the salts in the form of either chloride or carbonate had no effect on the calcium assimilation of diets deficient in calcium or of diets supplemented with adequate calcium. Also in the prevention, production, and cure of rickets, in which high-calcium, low-phosphorus diets were used, the magnesium salts did not increase the severity of the rickets, when the food intake was controlled. From these results it is evident that the digestive tract has the selective absorptive capacity necessary for the exclusion of an excess of magnesium.

Utilization of wild oat hay for fattening yearling steers, H. R. GUILBERT (*California Sta. Bul.* 481 (1929), pp. 21, figs. 2).—Concluding this 2-year study

with yearling cattle, the more important details of which have been previously noted (E. S. R., 61, p. 362), it was found that adding cottonseed meal to a ration of alfalfa hay and barley did not increase either the rate of gain or the finish attained. However, the combination of alfalfa with cottonseed meal had the advantage of producing a sleek appearance. In this study an intake of calcium oxide as low as 0.21 per cent of the total ration did not appear to limit the gains.

Dehorning these steers under favorable conditions prevented gains for a period of about 15 days, and for this reason it is recommended that cattle intended to be finished as yearlings should be dehorned as calves. The high-grade cattle in the study gained faster, yielded a higher percentage of carcass, and were carried to a high degree of finish more economically than the poor quality cattle.

The type of carcass demanded by the Pacific coast trade and some of the economic aspects of this study are briefly discussed.

Beef production in Great Britain, T. B. WOOD and L. F. NEWMAN (*Liverpool: R. Silcock & Sons, 1928, pp. 67, pl. 1, figs. 16*).—In this pamphlet the authors discuss the general systems of management of cattle in Great Britain and the possibilities for improvement so as to increase the returns. The composition of beef and methods of slaughter, dressing, and cutting are included, together with a discussion of the various cuts and the edible offals. Appended are anatomical and popular descriptions of cuts and tables of the composition of carcasses and cuts from carcasses of different types.

Cross-breeding experiment in the production of California spring lambs, R. F. MILLER (*Natl. Wool Grower, 19 (1929), No. 6, pp. 25, 26, figs. 6*).—Continuing this study at the California Experiment Station (E. S. R., 61, p. 259), the same ewes and the same breeds of rams were used, but the ewes were mated to rams of different breeds from those in the previous test. In addition 4 lots of 20 2-year-old crossbred Romney \times fine-wool ewes each were added to the experiment, and the lots bred to Southdown, Hampshire, Shropshire, and Suffolk rams.

In this phase of the study the Hampshire lambs averaged first in weight at marketing time and the Suffolks first in weight of lamb raised per ewe and in total number of twin lambs raised. The Southdown single lambs made good weights, but the average for the twins was lower than in the other lots. The birth weights of all lambs in the Rambouillet, Hampshire, and Suffolk lots averaged 10 lbs., in the Shropshire and Romney lots 9 lbs., and in the Southdown lot 8.3 lbs. The percentage of choice lambs was highest in the Romney lot, followed in descending order by the Shropshire, Hampshire, Suffolk, Southdown, and Rambouillet lots. The average dressing percentage ranged from 49.3 in the Southdown lot to 46.1 in the Rambouillet lot.

The average marketing weight of the lambs from the crossbred ewes was 66 lbs. for Suffolks, 62.1 for Hampshires, 55.5 for Southdowns, and 52.3 lbs. for Shropshires. The dressing percentage for these lambs ranged from 52.3 in the case of Southdowns to 49 in the case of Hampshires.

Production and feeding of lambs, L. H. ROCHFORD and E. J. MAYNARD (*Colo. Agr. Col. Ext. Bul. 295A (1929), pp. 34, figs. 23*).—The selection, care, management, and feeding of the breeding flock and market lambs are discussed in this popular publication.

The book of the goat, H. S. HOLMES PEGLER (*London: Bazaar, Exchange and Mart, [1929], 6. ed., rev. and enl., pp. 255, pls. 17, figs. 15*).—This treatise contains information concerning the various breeds of goats, methods of management, and the value of goats' milk and other products, and a popular discussion of some of the more common diseases and parasites of goats.

The Angora goat and mohair industry, G. T. WILLINGMYRE ET AL. (*U. S. Dept. Agr., Misc. Circ. 50* (1929), pp. [2]+120, figs. 44).—The importance of the Angora goat industry in the United States, the composition and characteristics of mohair fibers, the world distribution of Angora goats, the development of mohair production in the United States, the improvement and management of Angora goats, losses among goats, financing mohair growers, marketing Angora goats and their products, international trade in goats and mohair, standardizing of mohair grades, and manufacturing processes for mohair fibers are discussed in this publication.

Study of the heart beat of chick embryo, A. L. ROMANOFF (*Poultry Sci.*, 8 (1929), No. 5, pp. 298-300, fig. 1).—In a study made with the assistance of V. G. Vizbara at the New York Cornell Experiment Station, carefully selected eggs were placed in an incubator in which temperature, purity of air, and humidity could be controlled. Several eggs were removed from the incubator at 24-hour intervals, a portion of the shell and the outer membrane removed, and the rate of heart action determined for 5 consecutive minutes.

Individual variation in the heart beat of the embryos was much greater than the several interval observations of one embryo. The heart beat of the chick embryo increased up to 8 days and then remained about even for the rest of the incubation period.

Experimental studies concerning the development of the chicken embryo.—I, The toxic action of lithium and magnesium salts, W. LANDAUER (*Poultry Sci.*, 8 (1929), No. 5, pp. 301-312, figs. 14).—In these studies at the Connecticut Storrs Experiment Station, Ringer's physiological salt solution alone and various concentrations of the chlorides, sulfates, and bromides of lithium and magnesium dissolved in the solution were injected into the air space of developing eggs on the sixth day of incubation. While a few malformations were observed, there were no reasons to believe them due to the experimental treatment of the eggs. The sex ratios in these tests were not disturbed.

The injected fluids were immediately absorbed by the eggs. An injection of 2 cc. of Ringer's solution resulted in an increased mortality following the injection, with a corresponding decrease in mortality at the end of the incubation period. These results led to the belief that the experimental injection caused a selective mortality of weak embryos which would have succumbed under normal hatching conditions to the physiological adjustments just prior to hatching. When an M/20 solution of lithium chloride in Ringer's solution was injected, no appreciable embryonic death-rate increase occurred before the nineteenth day, but at this date a much greater mortality was apparent than under normal conditions. These results indicate that under normal incubating conditions the late mortality may be at least partially due to disturbances early in the development of the embryo.

Lithium compounds were more poisonous to the embryos than magnesium compounds. Further work showed that the poisonous action of these salts increased in direct proportion to the concentration.

Heat as a factor in producing abnormalities during incubation in the chick, M. T. HARMAN (*Kans. Acad. Sci. Trans.*, 31 (1922-1928), pp. 66-76).—In studies with two types of incubators, the author found that even small variations from the optimum temperature of 103° F. during the incubation period of chicks caused a high percentage of abnormal embryos. A variation of five or more degrees above or below the optimum resulted in a high mortality. The chick embryo survived longer at low temperatures than at high temperatures. In this study a great variation was found in the temperature in different parts of the same incubator.

The relation of inadequate rations to the weights of the internal organs of chicks. A. G. HOGAN, C. L. SHERWSBURY, and H. L. KEMPSTER (*Missouri Sta. Research Bul.* 122 (1929), pp. 23, figs. 2).—Concluding this study of synthetic rations for chicks (E. S. R., 62, p. 67), none of which were completely successful, it was found that upon post-mortem examination many cases of persistent egg yolks occurred. An attempt was made to correlate delayed resorption with nutritional failure, but no relation was found to exist.

Since all of the known nutritional factors were incorporated in these rations, an effort was made, by weighing the internal organs of a large number of chicks, to determine the possibility of at least one factor being present in insufficient quantity. These weighings showed that the adrenal glands of chicks weighing over 800 gm. and receiving synthetic rations were much heavier than the average for chicks on adequate rations. This weight difference suggests that the synthetic rations used were deficient in at least one factor of the vitamin B complex.

The calcium-phosphorus relationship in the nutrition of the growing chick. R. M. BETHEKE, D. C. KENNARD, C. H. KICK, and G. ZINZALIAN (*Poultry Sci.*, 8 (1929), No. 5, pp. 257-265).—In this more detailed account of work previously noted from the Ohio Experiment Station (E. S. R., 61, p. 456), it is pointed out that within certain limits of concentration, the ratio of calcium to phosphorus is of more importance for normal growth and calcification than the amounts of these elements present. When vitamin D or its equivalent is added to a ration a wider variation in the calcium-phosphorus ratio and concentration is possible for attaining normal growth and bone formation. This work also shows that phosphorus may be as much of a limiting factor in the growth and bone development of the chick as calcium.

The all-mash method of feeding chickens. F. C. BOBBY (*Jour. Min. Agr. [Gt. Brit.]*, 35 (1929), No. 10, pp. 950-962).—A comparison of the all-mash and the grain-and-mash methods of feeding chicks was made in two tests at the National Institute of Poultry Husbandry, using two lots of 243 chicks each in the first test and two lots of 237 chicks each in the second test. Lot 1 in each test was placed on an all-mash ration when 48 hours old, while lot 2 received a grain mixture until 7 days old, when a mash similar to the one fed above was added to the grain mixture.

In both studies there was no difference in the weight of chicks fed by the two methods at the end of 20 weeks, but it was noted in the first study that the chicks fed by the all-mash method grew somewhat slower at first than those in the control lots. The cost of feeding was slightly, but probably not significantly, lower in the all-mash groups. There was no significant difference in the mortality rates in any of the lots. These trials indicate the simplicity of the all-mash system, and the possibility of producing strong, well-grown chicks.

Culling poultry. E. L. DAKAN and A. R. WINTER (*Ohio Agr. Col. Ext. Bul.* 93 (1929), pp. 24, figs. 16).—In this very practical publication the authors discuss and illustrate by means of colored figures the factors to be considered in culling poultry.

Final report second Panhandle egg laying contest, November 1, 1927-October 25, 1928. O. S. WILHAM ([*Oklahoma*] *Panhandle Sta., Panhandle Bul.* 11 (1929), pp. 21).—A report of the second contest held at Goodwell, Okla. (E. S. R., 62, p. 69).

Poultry keeping for beginners in Hawaii. H. L. CHUNG (*Hawaii Univ. Agr. Ext. Bul.* 2 (1929), pp. [3]+24, figs. 18).—A popular publication dealing with the selection, management, feeding, housing, and marketing of poultry in Hawaii.

Goose farming in South Africa, E. F. LOMBARD (*Union So. Africa Dept. Agr. Bul.* 57 (1929), pp. 20, figs. 16).—This is a popular publication dealing with the housing, feeding, and management of geese in South Africa.

The durability of a glass substitute, W. C. RUSSELL and C. H. HOWARD (*Poultry Sci.*, 8 (1929), No. 5, pp. 290-297, figs. 2).—A biological analysis to determine whether 13.5 months of continuous exposure to weather conditions had decreased the efficiency of a glass substitute, Cel-O-Glass, was conducted at the New Jersey Experiment Stations, using three lots of 100 7-day-old White Leghorn chicks each. One lot was confined in a house in which the south wall was made of new Cel-O-Glass, the second lot in a house in which the south wall was made of 13.5-months-old Cel-O-Glass, while the third lot was kept as a control group out of contact with direct sunlight. Ash determinations were made at weekly intervals from February 15 to April 17 of the pooled femurs and humeri of 10 individuals from lots 1 and 2, and four times during the experiment from lot 3.

The Cel-O-Glass used in lot 2 transmitted enough ultra-violet light to produce the same bone formation as did the same material when new. No case of leg weakness or malformation of bones occurred in either lot. At a later date spectrographic measurements showed a decrease in the percentage transmission with weathering, but in this case the decrease was not sufficient to cause any difference in the bone formation.

Fur culture, edited by R. DEMOLL ET AL. (*Die Edelpelztierzucht. Munich: F. C. Mayer*, 1928, pp. [VII]+279, figs. 191).—In this work on fur farming silver fox culture is dealt with by R. Demoll (pp. 1-76); mink culture (*Mustela vison*), by L. Timmerhans (pp. 77-105); marten culture (*Martes* spp.), by A. Usinger (pp. 107-132); sable culture (*Martes zibellina*), by V. Generoso (pp. 133-147); skunk culture, by F. Gesele (pp. 149-164); raccoon culture, by F. Lamberts (pp. 165-182); muskrat culture (pp. 183-197), followed by a note on the culture of *Myocastor coypus* in South America (p. 198), both by L. Timmerhans; rabbit fur culture, by A. Will (pp. 199-232); and the production of karakul sheep pelts, by G. Fröllich (pp. 233-278). A list of 47 references to the literature is included.

Muskrat industry of Maryland, E. L. Lecompte (*Baltimore: Conserv. Dept. Md.*, 1929, rev. ed., pp. 36, figs. [20]).—This account deals with the life history and habits of the muskrat as applied to Maryland conditions, the importance of the industry, methods of trapping, propagation in captivity, and marketing of pelts and meat.

Practical muskrat raising, E. J. DAILEY (*Columbus, Ohio: A. R. Harding*, 1927, pp. 184, figs. 22).—This is a practical summary of information.

The observed effects of the addition of cod liver oil and minerals to the diet on the wool yield of Angora rabbits, J. N. PICKARD (*Harper Adams Util. Poultry Jour.*, 14 (1928-29), No. 9, pp. 420-424).—The University of Edinburgh, Scotland, conducted 4 tests with a total of 96 Angora rabbits, half of which received a normal diet and the other half a normal diet plus 3 drops of cod-liver oil per head for 6 days in each week. The lots receiving cod-liver oil produced a total of 2,729 gm. of wool as compared with 2,415 gm. of wool produced by the control lot, an increase of 13 per cent. Adding either calcium lactate or one of two commercial mineral mixtures failed to increase the wool yields.

DAIRY FARMING—DAIRYING

Raising dairy calves, E. WEAVER, C. A. MATTHEWS, and B. ODERKIRK (*Iowa Sta. Circ.* 119 (1929), pp. 32, figs. 7).—This is a popular publication discussing the proper methods of management, feeding, and care of calves to be used as

replacements in the dairy herd. A section prepared by C. H. Covault reviews some of the common diseases of calves and recommends methods of prevention and of treatment.

A suggested simplification of the present system of official testing with the dairy breeds of cattle, R. B. BECKER and P. C. MCGILLIARD (*Jour. Dairy Sci.*, 12 (1929), No. 4, pp. 337-350).—In this article from the Oklahoma Experiment Station the authors discuss a new plan for testing dairy cows which combines the Advanced Registry and Herd Improvement Register into a single system of supervision. Under this plan cows will be divided into three classes on the basis of their records of production during the Herd Test year, and testing under this plan will consist of 6 bimonthly 1-day and 1 surprise check tests. A discussion, based on the results of experimental work, in support of the proposed plan is presented.

Milk and milk products, C. H. ECKLES, W. B. COMBS, and H. MACY (*New York and London: McGraw-Hill Book Co.*, 1929, pp. XI+379, figs. 92).—This is a very comprehensive treatise intended for use in colleges of agriculture as an introductory course in dairying. The book is divided into the following chapters: Introduction, the constituents of milk, factors influencing the composition of milk, properties of milk, milk and dairy products as food, micro-organisms, the Babcock test for determining fat in milk and cream, common dairy processes, market milk, the manufacture of dairy products (butter, cheese, ice cream, condensed milk, dry milk, and milk by-products), dairy arithmetic, and miscellaneous tests.

The effect of diet on the copper content of milk, C. A. ELVEHJEM, H. STEENBOCK, and E. B. HART (*Jour. Biol. Chem.*, 83 (1929), No. 1, pp. 27-34).—In a study at the Wisconsin Experiment Station carried on with the cooperation of A. R. Kemmerer, the average copper content of the milk of 3 Holstein cows was determined by analyzing weekly samples for a period of 4 weeks. The copper in the ration was also determined. After the preliminary period, 1.2 gm. of copper sulfate, 5 times the amount of copper present in the ration, was added to each cow's diet. Samples of milk representing practically every section of the country were also analyzed for copper. Milk from goats on a normal ration and on the same ration supplemented with copper was analyzed to determine if any increase in the copper content could be detected.

On normal rations cows produced milk containing about 0.15 mg. of copper per liter. When the copper intake was increased 5 times by the addition of copper sulfate, no change in the copper composition of the milk occurred. Only slight differences existed in the copper content of milk from the 13 sections of the country represented. Increasing amounts of copper in a goat's ration did not change the composition of the milk. A limited number of tests failed to show that goat's milk was decidedly lower in copper content than cow's milk.

Market milk investigations (*New York State Sta. Rpt.* 1929, p. 50).—The creaming capability of frozen Holstein or mixed milk was found to be reduced slightly, but freezing had little effect on the creaming capability of Jersey milk. These studies have shown that all samples of frozen milk were restored to their normal creaming capability after being pasteurized.

The comparative accuracy of the direct microscopic and agar plate methods in determining numbers of bacteria in milk, J. D. BREW (*Jour. Dairy Sci.*, 12 (1929), No. 4, pp. 304-319).—A statistical analysis was made by the New York Cornell Experiment Station to compare the variability of the direct microscopic and agar plate methods for determining the number of bacteria in raw market milk supplies. In this study the variation was from

4.8 to 6.2 times greater with direct microscopic counts of individual cells per cubic centimeter than with counts of groups of bacteria under the microscope, and from 3 to 4.5 times greater than the agar plate colony count. The individual cell count averaged 4.5 times greater than the plain agar plate count, but where lactose was added to the agar the difference was reduced to 3 times, indicating that lactose increases the accuracy of the plating method.

There was little or no significant difference in the probable error of the coefficients of variability of the microscopic group count, of the individual cell count by the microscopic method, and of the agar plate count. A better correlation was obtained between the counts of individual cells and groups of cells per cubic centimeter by the direct microscopic method than between the individual cell count and agar plate count, but a poor correlation was obtained between microscopic group counts and agar plate counts.

This study does not indicate that any one method is more accurate than the other. The plating method is probably more applicable to counting bacteria in milk containing only a few thousand per cubic centimeter. Either method properly executed is sufficiently accurate to insure a marked reduction in the amount of poorly handled milk received.

The mold and yeast count as an index of the keeping quality of butter, H. MACY and H. B. RICHIE (*Jour. Dairy Sci.*, 12 (1929), No. 4, pp. 351-366, fig. 1).—To determine the relation between mold and yeast counts and the keeping quality of butter the Minnesota Experiment Station made a study of 597 samples, of which 297 were tub butter and 300 were in 1-lb. cartons. Counts of molds and yeasts were made of the fresh butter and at the end of storage periods ranging from 4 weeks to 5 months at temperature ranges of from 50 to 52° F. to -5 to -10°.

Mold counts varied from 0 to 4,800 per cubic centimeter, yeast counts from 0 to 90,000 per cubic centimeter, and total counts from 0 to 90,400 per cubic centimeter. When the butter was fresh there was no consistent relation between the mold and yeast counts and the quality of the butter. High yeast counts were in general accompanied by high mold counts. The samples of butter with the lower mold, yeast, and total counts tended to have slightly better keeping qualities than those with higher counts, but such counts of individual samples were not reliable indexes of the keeping quality of the sample.

Cheese investigations (New York State Sta. Rpt. 1929, pp. 49, 50).—In studies of packaging small amounts of natural cheese it was found that cured cheese was more desirable for this practice than green cheese. A treated edible coating for preventing mold growth and loss of moisture gave very good results in this study.

Experiments in the manufacture of cream cheese of the Neufchâtel type indicated the desirability of using ground agar rather than other types of agar or gelatin. Using a standardized cream or cream direct from the separator produced slight defects in the texture of this type of cheese. The study indicates that cream should be separated to contain the desired amount of fat and aged for a period of from 4 to 24 hours at cold storage temperatures in order to produce a cheese of good quality. Further work demonstrated the value of skim milk powder for improving the quality of cream and cottage cheese.

The relation of the hydrogen-ion concentration to the texture of Emmenthal or Swiss cheese, P. D. WATSON (*Jour. Dairy Sci.*, 12 (1929), No. 4, pp. 289-303, figs. 6).—The relation of increasing H-ion concentration to the texture of Emmenthal or Swiss cheese was studied by the Bureau of Dairy Industry, U. S. D. A. Differences in the proteolysis and the moisture of cheese

were correlated with the above factors. Variations were produced by the use of two starters, the *ga* starter, a *bulgaricus* organism with a mycoderm, and the *39a* starter, an old strain of *Lactobacillus bulgaricus*. Nine pairs of cheeses were made from identical milk, under approximated commercial practice, and were similar in all other respects except for the starters. Determinations of the pH and lactose content were made while the cheese was upon the press, and comparative studies were also made of the pH, proteolysis, moisture, freezing point, and texture when the cheese was 3.5 to 5 months old.

The data presented show that the use of the *ga* starter resulted in a markedly greater development of H-ion concentration during the first day than occurred when the *39a* starter was used. This increased acidity resulted in a more thorough proteolysis and a much harder texture in the *ga* cheese, and also indicated that less moisture was bound by the protein of this cheese. The cheese made with the *39a* starter generally contained more moisture, but probably not enough more to cause the difference in texture. From the results obtained it is apparent that a desirable soft texture in Swiss cheese is not necessarily coincident with the highest degree of proteolysis, usually the opposite being the case. The work further indicates the importance of the choice of a starter in the control of the H-ion concentration, ripening, and texture of Swiss cheese.

The manufacture of ice-cream, H. B. DAVEL (*Union So. Africa Dept. Agr. Bul.* 53 (1929), pp. 30, figs. 5).—In this publication the author discusses the materials and methods of making ice cream, the freezing of the mix, bacterial control, judging, and formulas for ice cream mixes.

The use of dehydrated egg products in the manufacture of ice cream, W. S. MUELLER and F. C. BUTTON (*Jour. Dairy Sci.*, 12 (1929), No. 4, pp. 320-335, pls. 2, figs. 2).—Further results in this study at the New Jersey Experiment Stations (E. S. R., 61, p. 767) show that 1 per cent of dried egg yolk had no detrimental effect upon the flavor of ice cream, while 1 per cent of dried whole egg imparted a slight off flavor to the product. The improvement in texture due to the use of dried yolk and dried whole egg was more noticeable in the mixes of low total solids content. On the other hand less time was required to reach 100 per cent overrun when these egg products were added to the high total solids mixes than when added to the low total solids mixes. Off flavors imparted by the egg products were more pronounced in the ice creams of low total solids content.

How butter affects whipping, W. J. CACIFIELD and W. H. MARTIN (*Ice Cream Trade Jour.*, 25 (1929), No. 9, pp. 56-59).—In ice cream studies at the Kansas Experiment Station the use of butter as a substitute for cream was investigated. Mixes calculated to contain 12 per cent of butterfat, 10 per cent of serum solids, 15 per cent of cane sugar, and 0.4 per cent of gelatin were used. In some mixes the source of butterfat was sweet cream and in others butter. Buttermilk was used in some of the mixes containing butter, and in still others efforts were made to improve the whipping properties of ice cream mixes containing butter through the use of dehydrated egg yolk powder and soybean lecithin.

The whipping properties of the ice cream mix were partially destroyed by the substitution of butter for sweet cream. It was evident that the churning process and not the treatment the cream received previous to churning was largely responsible for destroying these properties. The use of buttermilk in mixes containing butter resulted in but slight improvement in the whipping qualities. There were no significant differences in ice cream made with butter

from sour cream neutralized with either C. A. S. (sodium carbonate and sodium bicarbonate) or Perfection lime. Egg yolk improved the whipping qualities of mixes containing butter to a marked degree, but soybean lecithin proved a deterrent when used in ice cream mixes.

Stability of commercial sterilizers in the presence of milk, G. N. and S. N. QUAM (*Amer. Jour. Pub. Health*, 19 (1929), No. 7, pp. 737-739).—In a study of the effect of whole milk on the stability of commercial sterilizers, the authors used four compounds diluted to approximately 200 parts per million of available chlorine. The first sterilizer was a liquid sodium hypochlorite preparation strongly alkaline with sodium hydroxide, No. 2 a liquid sodium hypochlorite, No. 3 a crystalline trisodium phosphate sodium hypochlorite preparation, and No. 4 a chloramine-T preparation. A series of tests was conducted at five different temperatures, starting at 73.4° F. and gradually increasing to 145°. For each series 500 cc. of the sterilizer was placed in a sterile flask to which was added 1 cc. of whole milk, and the loss of available chlorine was determined at $\frac{1}{2}$ -, 1-, and $1\frac{1}{2}$ -hour intervals.

The fourth sterilizer was unusually stable at the lower temperatures, though a decrease in stability with each rise in temperature and extended exposure was noted. A definite, uniform decrease with increase of time for each temperature was noted for each sterilizer, the rate of deterioration increasing with the temperature. This rate of deterioration was specific for each sterilizer, and they ranked 1, 2, and 3 in the order of their increasing rate of deterioration.

The work emphasizes the great variation in the stability and activity of sodium hypochlorite sterilizers, and shows the importance of maintaining relatively low temperatures during the sterilization of dairy equipment.

Sterilization of milk bottles in soaker type washers, L. SHEERE and G. L. HOFFER (*Amer. Jour. Pub. Health*, 19 (1929), No. 7, pp. 747-750).—Bacterial counts of 1,835 bottles from 9 different washing machines were made at intervals over a period of 15 months in this study. Sample bottles were collected from the machines after soaking in caustic solution, after the brushing or pressure rinses, after plain rinsing, and after sterilizing. Plating of samples was done within 5 minutes after the bottles were removed from the machines.

In one case all of the bottles that emerged from the soaker solution had counts under 500, while on other runs counts were 99, 96, 94, 82, and 76 per cent satisfactory. Of the bottles delivered by the machine after soaking, rinsing, and sterilizing, in six of nine cases all had counts under 500, two were 99 per cent, and one 97 per cent satisfactory for compliance with bacterial count standards. All bottles which had been contaminated heavily with a suspension of *Bacillus coli* gave negative results. The study indicates the value of sterilizing milk bottles by exposure to temperatures of 165° F. for 5 minutes or to 195° momentarily, or of rinsing in a solution of chlorine disinfectant having a chlorine concentration of 35 parts per million of available chlorine.

Detergent properties of alkaline dairy washing compounds, M. E. PARKER (*Amer. Jour. Pub. Health*, 19 (1929), No. 7, pp. 751-757).—In this article the author discusses the bacterial effect of dairy detergents, especially from the standpoint of their cleansing properties. It is pointed out that chemical purity is necessary if consistent cleansing action is to be obtained. The author also suggests further studies dealing with the phenomena of emulsion and adsorption in so far as they may affect the penetration of germicidal substances to the bacteria held in greasy films on dairy equipment.

VETERINARY MEDICINE

Veterinary research report No. 4 (N. S. Wales Dept. Agr., Sci. Bul. 33 (1929), pp. 106, figs. 10).—The several papers here presented are as follows: Annual Report of the Director of Veterinary Research for the Year 1926-27, by H. R. Seddon (pp. 3-15); Studies of Caseous Lymph-Adenitis of Australian Sheep—I, A Review of the Disease as It is Seen in Australia, with Results of Some Bacteriological Studies, by H. R. Seddon (pp. 16-31). II, Observations on the Organ Incidence, etc., of Lesions of Caseous Lymph-Adenitis in Sheep, by R. C. Cramp (pp. 32-38), and III, A Discussion of the Method of Infection by Bacillus of Preisz-Nocard, by H. R. Seddon (pp. 39-43); Bone Chewing and Carrion Poisoning (Osteophagia and Botulism and Parabotulism) (pp. 44-50), Arsenic Poisoning as a Sequel of Bone Chewing in Cattle (p. 51), The Control of Liver Fluke (pp. 52-68), and The Danger of the Administration of Kerosene as a Medicine (pp. 69-71), all by H. R. Seddon; The Presence of *B[acillus] botulinus*, Type B, in Damaged Silage (pp. 72-75), An Atypical Form of Blackleg (pp. 76-80), and The Specific Identity of the Causal Organism of Black Disease in New South Wales (pp. 81-90), all by G. Edgar; and Feeding Tests with *Lantana crocea* (Red and Yellow-Flowered Lantana) (pp. 91-96), Feeding Experiments with Cape Weed (*Cryptostemma calandulaceum* R. Br.) (pp. 97, 98), Feeding Experiments with *Euphorbia peplus* ("Petty Spurge") (pp. 99-101), Feeding Tests with *Plantago varia* R. Br. ("Wild Sago," "Plantain," or "Lamb's Tongue") (pp. 102, 103), and An Investigation into the Shivers-Producing Principle of *Stachys arvensis* (pp. 104-106), all by H. R. Seddon.

Blood transfusions (intravenous and subcutaneous) in the treatment of anemias [trans. title]. J. CUIILLÉ and E. DARBASPEN (*Rev. Gén. Méd. Vét.*, 38 (1929), No. 453, pp. 513-530).—It is concluded from the study here reported that blood transfusion is the preferable therapeutic procedure in the treatment of anemic conditions of the domestic animals. Intravenous transfusion is recommended in the treatment of acute anemia and subcutaneous transfusion in chronic anemia.

A 3-page list of references to the literature is included.

Experimental infection of rats with the *Balantidium* from the pig, E. SCHUMAKER (*Science*, 70 (1929), No. 1816, p. 384).—Attempts to infect four rats with the cysts of *Balantidium* from the monkey resulted negatively, as did attempts to infect four rats with the *Balantidium* from the guinea pig.

Filterable virus and Rickettsia diseases in the Tropics, VI, E. B. MCKINLEY (*Porto Rico Rev. Pub. Health and Trop. Med.*, 4 (1929), No. 12, pp. 599-615).—This continuation of the accounts previously noted (E. S. R., 61, p. 871) includes a bibliography of 43 titles.

New technique for collecting intestinal roundworms, J. E. ACKERT and L. O. NOLF (*Science*, 70 (1929), No. 1813, pp. 310, 311, figs. 2).—This contribution from the Kansas Experiment Station deals with new features that have been added to the technic for collecting intestinal roundworms which greatly facilitate the removal and isolation of the young worms.

Zoological contributions to the surra problem, XXV, XXVI [trans. title], O. NIESCHULZ (*Zentbl. Bakt. [etc]*, 1. Abt., Orig., 113 (1929), No. 1-2 pp. 80-93).—In part 25, The Influence of Different Laboratory Animals on the Results of Surra Transmission Experiments with *Stomoxys calcitrans* (pp. 80-89), the author reports upon experimental work with more than 3,600 individual stable flies, in which the horse, monkey, rabbit, guinea pig, rat, and mouse were used. The chance for transmission was found to be 1:1,150 for the horse, from 1:23 to 1:27 for the rabbit, guinea pig, and rat, and 1:55 for the mouse.

In part 26, Transmission Experiments with *Tabanus rubidus* Wied. after Long Intervals (pp. 89-93), negative results were obtained in experiments with a large number of tabanids (*T. rubidus*) that engorged on surra-infected animals and at intervals of 1 to 84 days thereafter sucked the blood of uninfected horses, in all 7,434 times. The contents of the digestive tract of tabanids, removed 15 and 30 to 31 days after engorging on surra-infected horses, proved upon subcutaneous injection tests to be noninfective. No development of the trypanosome appears to take place in the tabanid.

Earlier work in this series is noted on page 454.

Current studies of undulant fever, H. E. HASSELTINE (*Pub. Health Rpts. [U. S.], 44 (1929), No. 28, pp. 1659-1666*).—This is a practical summary of information on undulant fever.

Treatment of undulant fever with acriflavine, A. M. HOFFMAN (*Jour. Amer. Med. Assoc., 92 (1929), No. 26, pp. 2169-2171, figs. 3*).—This is a report of the treatment of two cases of undulant fever due to *Brucella* infection which occurred in Los Angeles, Calif. It is concluded that acriflavine if given properly can do no harm, and that in the dosage attempted it did abort what apparently would have been prolonged sieges of the disease.

Sterility in the domestic animal, G. GEROSA and A. MIRRI (*La Sterilità degli Animali Domestici. Milan: Ist. Sieroterap. Milan., 1929, pp. [VII]+[247], pls. 14, figs. 53; abs. in Trop. Vet. Bul., 17 (1929), No. 4, pp. 143, 144*).—This work deals at length with the anatomy, etiology, pathology, and prophylactic measures for sterility, presented in connection with a 6-page list of references to the literature.

Studies on the control of Bang's abortion disease of cattle, C. C. PALMER (*Delaware Sta. Bul. 163 (1929), pp. 55, figs. 3*).—This consists of a summary of 10 years' study by the station of methods for the control and eradication of infectious abortion of cattle. An attempt first made to control the disease by the use of living-organism vaccines failed of satisfactory results. The administration of acriflavine intravenously to some 10 animals positive to the agglutination test also failed of the beneficial results expected, although none of the reacting cows, some of which were recently infected animals, aborted their calves within a period of 2.5 years after the treatment.

The greater part of the bulletin consists of a detailed account of control and eradication work with the disease in ten herds with five of which a system of partial segregation of the positive and negative reactors was employed and with the other five a system of complete segregation. In the partial system the cattle were segregated at calving time only, while in the complete system positive and negative animals were segregated at all times. Both systems were used successfully in the eradication of the disease.

In the first of the partial segregation herds there was 40 per cent infection at the outset, 4 years being required to eradicate the disease, which was accomplished with practically no additional cost to the owner. In the second of these five herds, in which the infection amounted to 10.8 per cent and was increasing rapidly, the disease was brought under control within 2 years, no new cases having appeared during the past 4 years. In the third herd, in which only two reactors were found in the first test, no new cases appeared during the following 5 years under observation and no reactors have been found in the herd during the past 4 years. In the fourth herd, work with which was commenced when the infection was increasing rapidly, the disease reactors were being eliminated gradually. In the fifth herd, in which 25 of the 102 animals reacted, the disease was eradicated in 2 years.

In the first of the five completely segregated herds, in which the first test showed 103 reactors, or 37 per cent infection, 18 months were required to

eradicate the disease. In the second herd, of 35 animals, in which the work was complicated by poor cooperation, the disease was brought under control in 2 years. In the third herd, consisting of 135 mature cows and bred heifers, of which 40 reacted at the initial test, an occasional reactor continued to appear after it was thought that the disease had been eradicated, but there have been no reactors in the last three tests. In the fourth herd, consisting of about 30 purebred animals purchased from several sources, the eradication of the disease was not difficult when the herd was divided, no reactors having been found in the negative herd in 2 years. In the fifth herd, in the eradication of which a father and son pooled their dairy interests, the father taking the negative herd and the son the positive herd, the disease was eradicated successfully. Starting with a herd of 24 animals in 1924, 50 per cent of which were infected with the abortion disease, the owners succeeded in establishing by 1929, or in less than 5 years' time, two negative herds of 20 animals each, exclusive of calves, by segregating the reacting animals, and in making no additions from the outside.

It is concluded that the method of segregation to be employed in the herd depends upon the circumstances surrounding the herd, such as buildings and amount of land available, finances of the owner, the value of the animals, the extent of the infection, the size of the herd, etc. If complete segregation of the reactors is not feasible, many variations of a modified plan of segregation may be put into practice, but the success of any plan depends upon the attention to details.

Under the heading of an abortion tragedy, an account is given of an attempt made to show the havoc resulting to a negative herd when the disease is introduced therein.

A list of 19 references to the literature is included.

Problem of vaccination against cattle abortion, E. T. HALLMAN (*Michigan Sta. Quart. Bul.*, 12 (1929), No. 2, pp. 50-52).—A brief account, in which it is pointed out that the American Veterinary Medical Association condemns the use of virulent vaccines to control this disease.

Experimental infection of bovines with *Franciella colchica* through ticks [trans. title], W. L. YAKIMOFF and E. F. RASTEGAIÉFF (*Zentbl. Bakt. [etc.]*, 1. Abt., Orig., 112 (1929), No. 1-2, pp. 69-73).—The experiments reported have shown *Boophilus annulatus calcaratus* to be the vector of *F. colchica* in northern Caucasus. The temperature rose 11 days after infected larvae were placed upon an 8-year-old cow. The parasites appeared in the peripheral blood on the sixteenth day. Hemoglobinuria appeared on the seventeenth day, and the cow succumbed on the eighteenth.

Immunization of cattle against rinderpest [trans. title], H. JACOTOT (*Arch. Insts. Pasteur Indochine*, No. 9 (1929), pp. 3-21, figs. 6).—The author has found it possible to prepare an antirinderpest serum by use of the pulp of organs of affected animals, the value of which clearly surpasses that of serums obtained through the injection of blood and peritoneal washings from affected animals.

[Absence of lesions in cattle reacting to the tuberculin test] (*New York State Sta. Rpt.* 1929, p. 47).—Reference is here made to the work of testing the station herd for tuberculosis which has been conducted experimentally since 1900, when the disease-free herd was segregated and since which a disease-free herd has been maintained. Up to 1927 the reactors in the disease-free herd were too few to be of any significance, but in that year the test failed to give clear-cut results in many cases. A study then commenced is now being made of the nonlesion cases with a view to determining the possibility of animals becoming sensitized to tuberculin. Related acid-fast organisms are

also being studied. The blood tests and avian tuberculin tests made during the year under report failed to indicate that there was any relation to irregularities in the regular tuberculin test.

The prevention of tuberculosis in cattle.—Further investigations to determine the value of the B. C. G. vaccine for the prevention of tuberculosis, H. A. WOODBUFF and T. S. GREGORY (*Jour. Council Sci. and Indus. Research [Aust.]*, 2 (1929), No. 3, pp. 137-150).—In continuation of experimental work at the Veterinary Research Institute, University of Melbourne (E. S. R., 59, p. 674), a number of calves were inoculated subcutaneously with amounts up to 100 mg. of B. C. G. None of these animals showed any ill effects, and the only lesion produced in each was a small nodule which varied in size and after 12 months had disappeared or remained only as a small fibrous tissue encapsulation of pus containing acid-fast bacilli. This led the authors to conclude that the vaccine used as recommended is innocuous.

"Twenty vaccinated calves were tested by intravenous inoculation of virulent tubercle bacilli to determine their resistance toward virulent infection. Six of these B. C. G. vaccinated calves died as a result of extensive tuberculosis in about the same time as control unvaccinated animals. Of the remaining 14, some showed clinical symptoms of infection, but later returned to normal. These surviving animals were subsequently slaughtered and some lesions of tuberculosis were found in the majority, but they did not indicate a progressive infection. It will be seen, in considering each test individually, that, both by clinical and post-mortem results, B. C. G. vaccination does confer some degree of resistance toward infection with virulent tubercle bacilli."

Experimental studies of the etiology of common warts in cattle, G. T. CREECH (*Jour. Agr. Research [U. S.]*, 39 (1929), No. 10, pp. 723-737, figs. 8).—In the author's investigations definite positive results were obtained in 15 out of a total of 22 calves inoculated with filtered or unfiltered wart material. Eight of the calves giving positive results were inoculated with the unfiltered wart material and 7 with the wart filtrates.

The results obtained indicate that common warts in cattle can be experimentally transmitted to bovines under 1 year of age with a fair degree of regularity. It was also demonstrated that filtrates of bovine warts, proved by cultural tests to be free from cultivable microorganisms, were capable of producing papillomata when inoculated intracutaneously into healthy cattle, and that warts produced by filtrate inoculations may be successfully transmitted in the second generation. The results of the filtrate experiments are considered to justify the conclusion that the causative factor in common warts of cattle is probably of the nature of a filtrable virus.

Lameness in lambs: A review of our present knowledge, H. R. SEDDON (*Agr. Gaz. N. S. Wales*, 40 (1929), No. 6, pp. 454-460, figs. 5).—It is shown that several quite distinct affections of lambs, different in cause, in symptoms, and in age of animals attacked, are included under the term lameness.

Recent experiments in immunizing young pigs against hog cholera, J. W. BENNER (*Vet. Alumni Quart. [Ohio State Univ.]*, 17 (1929), No. 2, pp. 79-88).—This is a report of a series of experiments that have been performed annually since 1922 by the New York Veterinary College. The details are presented in tabular form.

The absorption, distribution, and excretion of carbon tetrachloride in dogs under various conditions, B. H. ROBBINS (*Jour. Pharmacol. and Expt. Ther.*, 37 (1929), No. 2, pp. 203-216, fig. 1).—The author finds that carbon tetrachloride is absorbed quite readily from the intestinal tract, the rate of absorption varying with the species. In the dog there is little if any absorbed

from the stomach, but there is considerable absorption from the intestine and less from the colon. The amount absorbed increases with the dose and with the absorbing surface. The rate of absorption is increased by both alcohol and fat.

Ear mange in foxes: Its treatment and eradication. K. B. HANSON (*Amer. Fur. Breeder*, 2 (1929), No. 3, p. 13).—An account of the affection due to *Otodectes cynotis* which infests the inner surface of the ears of foxes.

The common poultry diseases, C. MURRAY (*Iowa Agr. Col. Ext. Bul.* 156 (1929), pp. 15, figs. 5).—This is a practical account of the diseases of poultry based upon Iowa conditions.

Prevent chick troubles, C. O. DOSSIN (*Penn. State Col. Ext. Circ.* 121 (1929), pp. 12, figs. 5).—An account of sanitary and other preventive measures applicable in combating diseases of chicks.

Abortion disease in the fowl, M. W. EMMEL and I. F. HUDDLESON (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 5, pp. 578-580).—This is a contribution from the Michigan Experiment Station.

In feeding experiments with 48 birds of various breeds, milk from the infected udder of a cow, portions of an aborted fetus, and pure cultures of the organisms served as sources of infection. An infection was produced in most of the experimental birds, death resulting in many cases and recoveries in a few, others being killed at intervals in order to study the nature of the disease. The course of the disease ranged from 18 to 96 days, the macroscopic lesions varying considerably, depending upon the rapidity of the course of the disease. The agglutination test was found to be a good index of infection, although a negative test was not necessarily a criterion of the absence of infection. During the last stages of the disease all birds except one showed a negative agglutination titer. This period of nonreaction may last from 2 to 5 weeks before death. The author reports having found 4 flocks in which natural infection occurred, 3 of the flocks having had a history of decreased egg production.

An experimental study of tests for the detection of carriers of *Bacterium pullorum*, S. T. MICHAEL and J. R. BEACH (*Hilgardia* [California Sta.], 4 (1929), No. 8, pp. 185-200, fig. 1).—The authors describe the methods used in the experiments at the station, and report tests with commercial pullorin, pullorins obtained from the Illinois Station, and pullorins prepared at the California Station.

It is concluded that the concentrated, alcohol-precipitated, and cell-suspension types of pullorin are not satisfactory preparations for use in the detection of carriers of *B. pullorum*. The agglutination test is so much more accurate for this purpose than intradermal tests performed with these types of pullorin that the latter should be discarded until a better agent for use in making tests by the intradermal method can be perfected. The preliminary results from intradermal injections of the cell-solution type of pullorin indicate that this preparation is a promising agent worthy of further trial.

The slide agglutination test in the detection of bacillary white diarrhea, P. R. EDWARDS and F. E. HULL (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 5, pp. 626-628).—This contribution from the Kentucky Experiment Station reports that antigens prepared for use in the slide agglutination test, and commercial antigens which have been examined, are lacking in sensitiveness. The slide test has been found quite satisfactory in detecting birds whose sera caused complete agglutination in a dilution of 1 to 80 or higher. It was found to be less efficient than the tube test in detecting birds whose sera agglutinated in lower dilutions only.

Some observations on the pathology of bacillary white diarrhea in baby chicks, H. BUNYEA and W. J. HALL (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929),

No. 5, pp. 581-591, figs. 10).—The authors find that pathological changes in the liver, such as mottled, pale, or other color, are not pathognomonic of pullorum disease in chicks, and neither is a partial or complete nonabsorption of the yolk substance. A high mortality in the first few days after hatching was not particularly characteristic of the disease as observed. It was found that an abrupt rise in the number of chicks dying on the sixth to eighth day after hatching, followed by a considerably decreased yet abnormally high mortality up to two weeks of age is very suggestive of pullorum infection. Necrotic spots in the lungs appear to have considerable diagnostic significance. The presence of gross intestinal lesions such as thickening and necrosis of the large intestine are indicative of infection by ingestion, and suggest brooder infection rather than incubator. It is pointed out that the frequent absence of any gross lesions in acute forms of the disease in baby chicks necessitates recourse to bacteriological procedures in diagnosing the disease with certainty in many cases.

Poultis susceptible to bacillary white diarrhea, M. W. EMMEL (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 5, p. 647).—In this contribution from the Michigan Experiment Station the author reports having isolated *Salmonella pullorum* from 6 poultis in 3 flocks, it having been found in the lungs of 4 poultis, livers of 5, hearts of 2, and the intestines of all of the birds. The poultis ranged from 2 to 3 weeks of age. Those from 2 flocks had been raised with baby chicks which later showed evidence of pullorum disease, and the history of the third flock was not obtainable.

Fumigation of forced-draft incubators, L. D. BUSHNELL, L. P. PAYNE, and C. J. COON (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 5, pp. 611-625).—This contribution from the Kansas Experiment Station reports studies which have shown formaldehyde fumigation to sterilize satisfactorily incubators of the forced-air draft type regardless of whether all ports are closed or left open. With a temperature of 99 to 100° F. and a wet-bulb reading of approximately 90°, 0.35 cc. of formalin liberated by 0.175 gm. of potassium permanganate per each cubic foot of space kills practically all exposed *Salmonella pullorum* organisms within 5 minutes after the formaldehyde has been liberated. Continuous fumigation with the pan method of evaporating the formaldehyde was found impractical. The minimum lethal dose of formaldehyde liberated by the hot-plate method was found to be between 60 and 70 cc. of formalin per hour. Chicks subjected to one short exposure of formaldehyde, liberated from 0.35 cc. of formalin added to 0.175 gm. of potassium permanganate per cubic foot of air space, with a wet-bulb reading of 90°, are apparently not injured.

Some aspects of fowl-pox and its control, F. R. BEAUDETTE (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 5, pp. 563-577).—This is a contribution from the New Jersey Experiment Stations presented in connection with a list of 38 references to the literature.

Vaccination for the prevention of fowl pox, E. M. GILDOW and C. A. BORTORFF (*New Hampshire Sta. Circ.* 30 (1929), pp. 12, figs. 6).—This account is accompanied by tables which show (1) the effect of age and number of follicles infected on the gain in weight in ounces of the birds vaccinated, (2) the results of duration of immunity tests made on birds vaccinated November 23, 1927, and (3) the immunity to fowl pox of birds vaccinated November 23, 1927, and tested May 9, 1928, and again October 4, 1928, showing continued resistance to infection. A table is also given which shows the effects of breed, time of vaccination, age of birds, etc., upon food consumption, egg production, mortality, and immunity production as compared with nonvaccinated controls.

It is concluded that the type and number of follicles infected have an important bearing on the success of vaccination. "In general the smaller the number of follicles infected the less was the evidence of vaccination sickness. Any number of follicles used, from three to twelve, if a 'take' results, appears to confer lasting immunity. Rhode Island Red pullets from 25 to 55 months of age may be successfully immunized to fowl pox. Vaccinated birds, in which the disease was not previously present, do not appear to transmit pox to susceptible birds 4 months after vaccination. Fowls may be successfully immunized in the field by this method of vaccination. Birds suffer less from vaccination sickness during the summer season. Pullets and cockerels should be vaccinated after they have been culled and before the pullets come into production. All susceptible birds on the farm should be vaccinated within a reasonably short time, unless adequate means of quarantine are at hand.

"Barred Rock hens which had not molted were thrown into a molt when vaccinated after the last of August. Six-months-old Leghorn pullets vaccinated after August 1 dropped off one-fourth in egg production and showed some molt. Six- to 10-months-old Red pullets vaccinated after November 24 dropped from 39 to 25 per cent in production. Vigorous Rhode Island Red pullets under 6 months of age vaccinated before August 1 gave complete satisfaction."

The stick method of cutaneous virus vaccination against fowl-pox, W. T. JOHNSON (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 5, pp. 629-646, figs. 3).—In this communication from the Oregon Experiment Station the author describes a method of cutaneous virus vaccination for the control of fowl pox, called the stick method, which has proved to be highly satisfactory. The method has been applied almost exclusively to the common domestic fowl, but its limited use on turkeys is also considered. The small amount of virus used, rapidity of application, and uniformity of takes especially recommend it.

The effect on healthy pullets of preventive vaccination against chicken-pox, J. R. BEACH (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 5, pp. 592-610).—This is a report of the vaccination of healthy young fowls with living fowl pox vaccine at the California Experiment Station which showed that with birds in good condition the undesirable results are not liable to occur frequently, and that the vaccination of healthy cockerels and nonlaying pullets or hens is a relatively safe procedure. The hazard attending the vaccination of laying pullets, although apparently greater than of nonlaying birds, does not seem to be great enough to make this a practice to be avoided entirely in case the flock without vaccination is quite certain to become infected with fowl pox later.

Chicken pox control by inoculation, R. E. JONES (*Conn. Agr. Col. Ext. Bul.* 129 (1929), pp. 6, figs. 4).—A practical account in which it is pointed out that inoculation with live scab material will control chicken pox, and that chickens should be inoculated at from four to five months of age.

The growth of *Pasteurella avicida* in the body of the fowl, L. D. BUSHNELL and V. D. FOLTZ (*Jour. Infect. Diseases*, 45 (1929), No. 4, pp. 308-315, figs. 3).—Studies at the Kansas Experiment Station indicate that there is a marked difference in individual cells of the same bacterial culture of *P. avicida*. Some cells are capable of surviving in the body of the bird while others are not. In artificial media practically all the cells present seem to be able to survive and grow. There is a difference in the vegetative function and aggressive function of bacterial cells. This difference is probably the basis of virulence in these organisms.

"*P. avicida* appears to have an organ virulence for blood and is able to grow irrespective of the manner in which introduction is made. The organisms possess so little toxicity that they do not call forth any marked response on

the part of the host. However, the exudation into the lungs may be due to serotoxins or some product due to the interaction of the bacteria and serum or tissue cells which does not appear in artificial culture."

Avian tuberculosis in Nebraska, C. H. HAYS (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 5, pp. 549-562).—This is a paper presented at the annual meeting of the American Veterinary Medical Association in Detroit in August, 1929.

A new roundworm parasite, *Strongyloides avium*, of the chicken, with observations on its life history and pathogenicity, E. B. CRAM (*North Amer. Vet.*, 10 (1929), No. 8, pp. 27-30).—Under the name *S. avium* n. sp. the author describes a nematode parasite found, exclusively in the mucosa of the ceca, in all of a lot of six chickens from two flocks in Louisiana. The complete life history of the parasite has been determined experimentally, and descriptions are given of its various stages. Chickens and bobwhite quail have been infected experimentally. The parasite is of pathological significance as it produces marked changes in the walls of the ceca.

The control of poultry lice, mites, and worms, W. M. VERNON, K. W. STOUDEB, and R. L. COCHRAN (*Iowa Agr. Col. Ext. Bul.* 155 (1929), pp. 15, figs. 9).—This is a practical account.

AGRICULTURAL ENGINEERING

Engineering applied to agriculture, H. B. WALKER (*Agr. Engin.*, 10 (1929), No. 11, pp. 341-349, figs. 12).—This contribution from the California Experiment Station was presented before the World Engineering Congress at Tokyo, Japan, in October, 1929. It is a comprehensive review of the status of agricultural engineering in the United States. Attention is drawn to the fact that research work in this field is conducted now by 103 full-time workers in 34 land-grant experiment stations.

The Mohave Desert region, California, D. G. THOMPSON (*U. S. Geol. Survey, Water-Supply Paper* 578 (1929), pp. XI+759, pls. 34, figs. 20).—Following a preface by O. E. Meinzer, the results of a geographic, geologic, and hydrologic reconnaissance of the Mohave Desert region of California are presented.

A summary of studies on the depth of irrigation water for lowland rice in western Laguna, A. GORDON (*Philippine Agr.*, 17 (1929), No. 10, pp. 579-592, pl. 1).—The results of seven studies carried on in six different years on farms in western Laguna by the agricultural experiment station of the University of the Philippines to determine the depth of irrigation water from the preparation of the field for rice to the harvest are summarized graphically and otherwise.

The soils of rice fields in Binang, Calamba, Calauan, and Santa Rosa, Laguna Province, are of the clay loam type.

The average depth of irrigation water used during the preparation of the fields was 11.1 cm. (4.37 in.). There was an average of 44 days of irrigation during the preparation of the fields. The deepest irrigation during preparation was after plowing. The average depth of irrigation water used for each variety was: Binangbang-puti 6.2 cm., Binicol 12.3, Guinangang 10.1, Inadhika 9.3, Macan 2.9, Mangasa 9, and Nagsalit 2.6. The average depth was 7.5 cm.

The probable irrigation curves for each variety are good guides for the irrigation of the crop. The probable irrigation curve for any variety is a guide which may give a fair result for any crop irrigated according to it. Studies should be carried on for some time to get the best irrigation curves.

A bibliography is included.

The rational method of estimating run-off from small agricultural areas, C. E. RAMSER, R. A. NORTON, and W. D. ELLISON (*Agr. Engin.*, 10 (1929), No. 11, pp. 351-353, fig. 1).—This report of the committee on run-off from agricultural lands, presented at the June, 1929, meeting of the American Society of Agricultural Engineers, describes the method.

The method is based on the theory that the maximum rate of run-off from a watershed occurs when rainfall from every portion of the watershed is contributing to the flow at the outlet. In order that the most remote point (measured in time) is contributing to the flow at the outlet, it is necessary that the rain continue as long as it takes for the water to travel from the most remote point to the outlet. The time required for the water to travel this distance is called the time of concentration for the watershed. The maximum rate of run-off would therefore occur for a rain of maximum uniform intensity over the entire watershed that continues as long as the time of concentration for the watershed.

The method is expressed by a formula, $Q=CIA$, where Q is the rate of run-off in cubic feet per second from a given drainage area; C is a coefficient representing the ratio of the maximum rate of run-off to the maximum rate of rainfall for the period equal to the time of concentration; I is the maximum rate of rainfall in cubic feet per second per acre of watershed, or approximately in inches per hour; and A is the drainage area in acres.

Public Roads, [November, 1929] (*U. S. Dept. Agr., Public Roads*, 10 (1929), No. 9, pp. 153-176+[2], figs. 38).—This number of this periodical contains the status of Federal-aid road construction as of October 31, 1929, and an article on Earth Pressure Experiments on Culvert Pipe, by G. M. Braune et al. (see below).

Earth pressure experiments on culvert pipe, G. M. BRAUNE, W. CAIN, and H. F. JANDA (*U. S. Dept. Agr., Public Roads*, 10 (1929), No. 9, pp. 153-176, figs. 37).—The results of experiments relating to earth pressures on culvert pipe conducted by the University of North Carolina in cooperation with the North Carolina Highway Commission and the U. S. D. A. Bureau of Public Roads are presented in considerable detail. The tests were conducted on 20- and 30-in. pipe of various materials, using sand and clay fills. In all tests of the first series the pipe was placed in what is termed "the condition of 50 per cent projection," that is, only one-half of the circumference of the pipe was exposed to the fill. In the first portion of this series the fill was placed over the pipe exposed in this manner, and later conditions were modified by placing and compacting a portion of the fill and then excavating a narrow trench to expose the pipe in condition of 50 per cent projection. The trench was then back filled and the fill completed in the usual manner. This was called the "trench condition." The most pertinent data were obtained in the second series of tests, in which the entire surface of the pipe was exposed to the fill and information was obtained not only as to the load on the pipe but also as to the radial earth pressure and the deflection of the pipe.

In sand fill tests it was found that for equal heights of fill the pressures during removal were greater than during the filling. This was because the pipe was already deflected during removal. The pressure upon the top of the pipe was lessened as the earth was removed and the pipe tended to recover its original shape. It was partially restrained by the passive pressure of the prism of earth. Thus the pipe acted as a compressed spring and exerted an upward pressure until the passive pressure could be overcome.

Tests with clay fill and 50 per cent projection showed that the pressure on the pipe was approximately equal to the weight of the earth directly over it.

The pressures during removal of the fill were greater than during the filling at equal heights, as in the first test and for the same reason.

Tests with clay fill in the trench condition showed that the vertical pressures on the pipe were less than in the 50 per cent projection condition, using the same filling material.

The pressures decreased from March 3 to the middle of August, when a total decrease of 33 per cent had taken place. After that time a slow increase occurred, until at the conclusion of the test approximately one-third of the lost pressure had been recovered. The rapid decrease in pressure may be attributed to the drying and shrinking of the initially saturated clay resulting from the summer's unusually low rainfall. The increase in pressure is probably the result of a slow failure of the trench and of an increase in moisture content of the clay during the fall and winter months. Variations in the rainfall have but little effect, if any, upon the pressure.

Tests of the transmission of pressure from concentrated loads through the fill showed a residual pressure on the pipe after the passing of the roller for the 50 per cent projection condition but not for the trench condition. The maximum increase of pressure occurred when the rear or heavy roller was directly over the center line of the culvert. The increase in pressures for low fills was quite marked. For the trench condition the increase was not marked unless one of the rollers was over the trench. It appeared that after the passage of the roller over the 7.05- and 5.4-ft. fills, trench condition, there was less pressure than before. No reasonable explanation for this phenomenon was discovered.

Further tests in the trench condition of 20- and 32-in. solid plugs, 20-in. smooth iron and corrugated metal pipes, and 30-in. concrete, cast iron, steel tube, corrugated metal, and smooth iron pipes showed that, except for the first few feet of fill, the load carried increases with the height of fill at a uniform rate. The data also indicate a direct relation between the vertical load and the flexibility of the pipe.

The load-deflection ratio for the rigid pipes plots approximately as a straight line throughout, whereas the deflections of the more flexible pipe increase rapidly at first and then more slowly as the side pressure increases. On the rigid pipe the radial pressure is high at the top and low at the sides. On the flexible pipe the radial pressure is slightly higher on the sides than on the top. This variation in pressure on the two pipes is to be expected when it is realized that the flexible pipe acquires its strength through side support.

An attempt was made to correlate field data with the laboratory findings. The tests were made on a section of smooth iron pipe 30 in. in diameter and having a thickness of 0.100 in., and also on a section of steel tube 30 in. in diameter with a thickness of 0.340 in. There was a wide discrepancy between the pressures and deflections obtained by this method and those obtained in the field, and it was decided that field conditions could not be simulated with the apparatus.

A study of the data obtained from these experiments indicates that the magnitude of the earth pressure transmitted to the pipe is to a large degree a function of the flexibility or deflection of the pipe. If the pipe is of such rigidity that its deflection is equal to the settlement of the adjacent fill, the value of the ratio of the earth pressure to the weight of the earth prism directly over the pipe will be unity; that is, the load carried by the pipe will be equal to the weight of the prism of earth vertically above the pipe. If this rigidity is increased, the load carried will also be increased, whereas if the rigidity is decreased the earth pressure transmitted to the pipe will be decreased. Using

a proper ratio or factor the ultimate strength of any rigid pipe as determined by the 3-point bearing test can be converted into its equivalent load-carrying capacity for earth embankments. The method can not be applied to flexible types of pipe. Three-point bearing tests on flexible pipe when compared with actual embankment loads show that there is no one factor that can be used to determine field loading from laboratory loading. This is due to the fact that the structural strength of flexible pipe in the 2- or 3-point bearing test is only a part of its load-carrying capacity, the remaining portion being due to side support which is developed as passive pressure on the sides of the pipe.

Two appendixes on notes relative to vertical pressures on pipe culverts, and on stresses and deflections of pipe culverts are included.

Standard specification for concrete and reinforced concrete (*Ottawa: Canad. Engin. Standards Assoc., 1929, pp. 152, pls. 2, figs. 25*).—The text of this specification is given.

Tensile strength of bolted, riveted, and welded mild steel joints, J. G. DENT (*Agr. Engin., 10 (1929), No. 11, pp. 354-356, figs. 4*).—Tests conducted at the Minnesota Experiment Station are reported. Of 60 black-mith forge welds tested, 53 failed in the weld, most of them along the line of the weld all or part way. Of the 7 welds which did not fail, 5 were not affected by the strain, the bar necking down and failing several inches from the weld. The other 2 failed about 1 in. from the weld.

Overheated and slightly burned welds were stronger than the underheated ones. Nearly all of the welds pulled apart along the line of weld without tearing the metal except at the scarfed ends and sometimes not even there. This would seem to indicate that the metals were nearly always underheated. The line of weld showed rather plainly before testing in many cases.

Of 60 oxyacetylene welds, 55 failed in the weld. The 5 welds which did not fail were not affected by the strain and the bar failed a considerable distance from the weld. The average tensile strength of the 60 acetylene welds was 84 per cent as compared to 89 per cent for the forge welds.

Substitutes for wooden breakpins, A. H. HOFFMAN and E. G. MCKIBBEN (*California Sta. Bul. 482 (1929), pp. 22, figs. 17*).—Comparative tests of wooden and metal breakpins for the hitches of tractor-drawn implements indicated that the oak pins usually supplied with tractor plows and other heavy tillage implements vary greatly in breaking strength. Often the strongest in a lot of a dozen oak pins, identical in size and make, will carry twice the load that will break the weakest. In one lot in the tests the ratio was 3.8. On the other hand, soft iron or steel rivets are much more uniform in strength, the greatest difference observed between the strongest and the weakest of a size being only about 33 per cent. Steel wire nails are slightly less uniform than rivets. The metal substitutes for breakpins are not only more uniform but less expensive, and much less bulky.

The results of comparative tests of three spring overload release hitches were previously noted from another source (*E. S. R., 60, p. 80*).

The combine harvester in Minnesota, A. J. SCHWANTES, R. H. BLACK, ET AL. (*Minnesota Sta. Bul. 256 (1929), pp. 50, figs. 11*).—The results of an investigation of the status and use of the combine in Minnesota agriculture are presented in considerable detail. The work was done by the station in cooperation with the U. S. D. A. Bureaus of Agricultural Economics and Public Roads.

Plump, hard spring wheat kernels that are sound and normal will ordinarily remain sound and cool throughout the fall and winter if they do not contain more than 14.5 per cent of moisture. With shrunken, soft, or sprouted grain, the safe moisture limit is probably 0.5 to 1 per cent lower than that. The safe

maximum limit is lower for oats and barley than for hard spring wheat, being not more than 13.5 per cent. Harvest should be delayed until the moisture content of the grain has dropped to about 14 per cent. All varieties of the same cereal required about the same time to reach the stage for safe harvesting with the combine. Not quite so much moisture is taken on during the night by grain in the windrow as by uncut grain, hence combining might be possible earlier in the morning from the windrow than from standing grain. On the other hand, standing grain dries more rapidly after rains than grain in windrows.

Weeds are one of the outstanding hindrances to successful combine operation. The majority do not ripen until after the grain is harvested, although seeds have formed in most of them. These seeds contain from 20 to 60 per cent of moisture, depending upon the relative maturity of the plants. The percentage of moisture varies with the season and the locality, and the variety of weed. Windrowing is almost indispensable in very weedy fields.

Barley was less adapted than oats for harvesting with the combine, as far as lodging was a factor. All varieties lodged badly at University Farm and Morris before they were ready to harvest with the binder. The lodged barley reached the 14 per cent moisture stage somewhat later than did Gopher oats, the straw of which stood erect. Crinkling and shattering, particularly after heavy rains, caused most of the reduction in yields. Oats lodged less than barley, but crinkling and shattering started soon after they became dead ripe and were the main factors responsible for reductions in yields. Wheat lodged less than the barley varieties and crinkled and shattered less than either barley or oats. This enabled the wheat to stand in the field through heavy storms after it was dead ripe with less marked decreases in yield. The losses that occurred were due to crinkling and consequent loss of spikes rather than to shattering. Loss of bolls caused most of the reduction in yields of flax.

Losses due to lodging are much higher when harvesting with the binder than when harvesting with the combine. The combine harvester picks up lodged grain fully as well as the binder. When lodged grain is cut with the binder and bound, subsequent losses are heavy because bundles can not be made properly. As there is no possibility for losses after cutting with the combine, lodging becomes much less important.

If the moisture content of grain harvested with a combine is 14 per cent or less at time of harvesting, no special precautions need be taken in storing. If it is necessary to harvest with a combine grain that contains a little too much moisture, the grain can usually be safely stored in properly ventilated bins. Grain harvested with a combine should always be cleaned before it is stored if it contains green weed seeds. It can not be safely stored even in ventilated bins.

Data are also given on harvesting and threshing losses, combine adjustment and care, and on combine harvesting cost.

A promising cassava grater for the farm, Z. MONTEMAYOR (*Philippine Agr.*, 17 (1929), No. 10, pp. 593-597, figs. 2).—A cassava grater developed by the agricultural experiment station of the University of the Philippines is briefly described and illustrated, and the results of service tests presented.

The application of steam for heating and sterilizing dairy equipment, A. W. FARRALL (*Jour. Dairy Sci.*, 12 (1929), No. 2, pp. 95-113, figs. 15).—The results of experiments conducted at the California Experiment Station and presented at the June, 1928, meeting of the American Dairy Science Association on the use of steam for heating and sterilizing dairy equipment, are reported.

It was found that the most important properties of steam which affect its use as a sterilizing medium are that the temperature of the saturated steam

increases with pressure and may be raised by superheating, and that superheated steam absorbs moisture.

Equations are developed which state the relationship between the factors involved in the thermal exchange which takes place when milk cans are steamed. The heat-absorbing capacity of a milk can is limited by the area of the surface, the coefficient of heat transfer, and the temperature difference between it and the heating medium. It is unnecessary to use any more steam than just enough to maintain the temperature of the heating medium inside the can and to give the necessary turbulence to insure a good coefficient of heat transfer.

Wet and saturated steam heated the cans at higher rates per degree difference in temperature between the can and the steam than did the superheated steam. Higher final temperatures of the can were obtained when superheated steam was used. With a spreading type jet made by drilling a hole in a 0.5-in. pipe, the temperature in the can metal varied about 14.6° F. after 15 seconds' steaming, and varied about 5.7° at the end of a half minute steaming period. The hottest part of the can was near the junction of the sides and bottom.

Steaming with superheated steam left much less moisture in the can than when saturated or wet steam was used. The use of superheated steam in the last steam jet of a continuous can washer assists in drying the cans.

The time-temperature curve, showing the rate of temperature rise of milk cans when heated over steam jets, rises rapidly to a point where it flattens out sharply as the temperature is reached when there is equilibrium between heat supplied and heat radiated.

Milk cans when heated slowly in a steam heated tank type sterilizer follow the sterilizer temperature closely. Milk cans when heated slowly in a hot air heated tank type sterilizer lag behind the temperature of the sterilizer to a considerable extent.

Construction of milk cooling houses and insulated tanks, F. W. SMALL (*Agr. Engin.*, 10 (1929), No. 12, pp. 383, 384, figs. 4).—Practical information is given on the subject.

Performance tests on evaporation type coolers, W. L. RUDEN (*Agr. Engin.*, 10 (1929), No. 11, pp. 349, 350, figs. 5).—The results of tests of metal-frame and wood-frame evaporation type coolers at the California Experiment Station are briefly reported.

Canvas is superior to muslin as a covering material because it does not dry out so readily and is more durable. Although burlap ranks about 20 per cent higher in performance than canvas, it is not that much superior. It dries out easier, is not so durable, and may be faulted from a sanitary viewpoint. Any evaporation type cooler should be well shaded at all times. Even filtered sunlight as it comes through trees lowers its performance to a marked extent.

The conclusion is drawn that, if properly constructed, the evaporation type cooler will give satisfactory results in all except the humid regions. However, it is not equal to a refrigerator, except in very dry regions in reasonably high altitudes where the air temperature does not get very high. Rather it should serve as a supplement to a refrigerator in taking care of vegetables and similar foods to which it is peculiarly adapted. Where ice or mechanical refrigeration is out of the question, an evaporation type cooler will serve as a fair substitute.

Data on ultra-violet solar radiation and the solarization of window materials, W. W. COBLENTZ and R. STAIB ([U. S.] *Bur. Standards Jour. Research*, 3 (1929), No. 5, pp. 629-689, figs. 23).—This paper deals with (1) the

amount of ultra-violet in solar radiation of wave lengths less than about 310 $m\mu$ found to be of especial use in preventing rickets but shut out by common window glass, (2) the decrease in transmission that occurs in the newly developed window glasses for transmitting ultra-violet of wave length less than about 310 $m\mu$ when exposed to ultra-violet radiation, and (3) the proper use of windows in order to obtain the most effective therapeutic results.

By four methods of attack, data were obtained showing that the upper limit of the total amount of ultra-violet solar radiation, of wave lengths less than about 310 $m\mu$ is less than 0.004 g. cal./ cm^2 /min. at sea-level stations.

It is shown that nearly all these newly developed window glasses decrease in transmission, especially in the ultra-violet of wave lengths less than 310 $m\mu$, when exposed to the sun and to artificial sources containing ultra-violet radiation. In some makes of glass there is practically no decrease in transmission as the result of photochemical aging; other glasses lose almost one-half their transparency at 302 $m\mu$ in the process of photochemical stabilization. Concerning the use of windows, data are given showing that, with variation of the angle of incidence of the solar rays from normal upon the solarium, during the year and during the day, the amount transmitted through the glass decreases by about 20 per cent. The necessity of keeping the glasses clean is indicated by the observations that dust and dirt reduce the transmission at 302 $m\mu$ by 30 to 40 per cent.

Double thickness (0.25 in., 6 mm.) wired glass, even when made of these newly developed materials (except, perhaps, Corex-D and pure quartz glass) after complete photochemical stabilization, transmits only 3 to 5 per cent at 302 $m\mu$, which is probably too low for therapeutic use. Hence, a glass of single thickness (2.5 mm.), with a wire mesh under it for safety from breakage, is recommended for solarium roofs.

A bibliography is included.

The Connecticut 20×30 laying house, R. E. JONES (*Conn. Agr. Col. Ext. Bul. 138* (1929), pp. 16, figs. 13).—This poultry structure is described and illustrated.

RURAL ECONOMICS AND SOCIOLOGY

Report of proceedings of a conference of the [Agricultural Economics] Society ([Reading, Eng.]: *Agr. Econ. Soc.*, 1928, pp. 55, pl. 1).—Continuing the series previously noted (*E. S. R.*, 38, p. 586), the following papers, with discussions, presented at the conference of the Agricultural Economics Society held at Oxford, July 6-9, 1928, are included: The Scope of Agricultural Economics, by H. Rew (pp. 11-21); An Examination of the Notion of Net Output, by H. M. Conacher (pp. 22-25); Survey Methods as an Approach to the Study of Agricultural Economic Problems, by A. Bridges (pp. 26-38); Some Materials for the Economic History of Agriculture, by E. Rideout (pp. 39-42); and The Relation of Research to Extension Work in Agricultural Economics, by C. E. Ladd (pp. 43-47).

Farm business studied in Kalamazoo County, [Michigan], F. T. RIDDELL (*Michigan Sta. Quart. Bul.*, 12 (1929), No. 2, pp. 44-50, fig. 1).—The results of a farm business analysis survey of 49 farms made in April, 1929, for the crop year 1928 are presented and discussed.

A table is given showing for the 49 farms and for the 16 most profitable and the 16 least profitable farms, by items, the average capital investment, receipts and inventory increases, expenses, acreage and yield of crops, and number of and income from different kinds of livestock; and also data as to the size of

business, labor efficiency, horse and mechanical power, farm income, operator's earnings, expenses per \$100 receipts and net increase, etc.

Economic studies of dairy farming in New York, IX. J. C. NEEHLING (*New York Cornell Sta. Bul.* 433 (1929), pp. 93, figs. 18).—The results for the fifth year—that ended April 30, 1926—of the study previously noted (E. S. R., 59, p. 587) are reported in the same form as in the previous bulletins, and the results for the 5 crop years studied are summarized, analyzed, and compared.

During the 5 years 509 records were taken. These included records from 54 farms for 5 years, 17 farms for 4 years, 27 farms for 3 years, 14 farms for 2 years, and 62 farms for 1 year. The average labor income for the 5 years was \$580, varying from \$32 in 1922 to \$1,676 in 1925. For the 5 years 34 per cent of the farms had labor incomes of —\$1 and less, 35 per cent from \$1 to \$999, 21 per cent from \$1,000 to \$1,999, and 10 per cent over \$2,000. The cost of producing milk and the percentage of the total income derived from crops sold were the factors found to have had the greatest influence on labor income, accounting, respectively, for 18 and 17 per cent of the influence of the various factors during the 5 years.

The costs per 100 lbs. of milk produced in the different years varied from \$2.74 to \$3.07, averaging \$2.85, and the returns from \$2.49 to \$2.79, averaging \$2.60, an average loss per 100 lbs. of milk of 25 cts. Of the cost, 56 per cent was for feed and 22 per cent for labor. The cost of milk depended mainly on the cost of feed and labor, production per cow, and distance to market. Grade and percentage of cows freshening in the fall were the factors having the greatest effect on production per cow. Mixed herds made the best labor incomes, and the production per cow increased as the percentage of cows freshening from September to December, inclusive, increased.

Labor income had a tendency to increase as the percentage of the income derived from crops increased. Hill farms were more profitable than valley farms during the 5 years studied. Share-rented farms gave landlords better returns. Tenants made better returns on cash-rented farms, but furnished more capital than on share-rented farms. In general, labor income tended to increase with the amount of capital invested up to \$25,000, after which there was a decrease.

The study was made in cooperation with the U. S. D. A. Bureau of Agricultural Economics.

Dairy-farming in British Columbia, H. R. HARE (*Brit. Columbia Dept. Agr. Bul.* 103 (1928), pp. 101, figs. 66).—This economic study is based on 726 annual detailed business records from over 300 farms in five areas of the Province for the years 1921–1925. Following a general description of the districts studied and the status of the dairy industry, the data are analyzed under the headings of farm organization in the various dairying districts, size of farm as a factor in dairy farm organization, owned v. rented farms, dairy farming as influenced by butterfat production per cow, the effect of crop yields, specialized dairy farming, and the cost per pound of producing butterfat. Numerous tables and graphs present the data for the various areas.

Tree-fruit farming in British Columbia, F. M. CLEMENT and J. C. WILCOX (*Brit. Columbia Dept. Agr. Bul.* 105 (1929), pp. 51).—This economic survey is based on 460 records obtained in the Okanagan district and 66 in the Kootenay district. The records cover the years 1921–1925 and were obtained each year by field enumerators. The investment, expenses, receipts, and net returns for the period are analyzed, and the effects of amount of investment, acreage in bearing apples, yield per acre of apples, and diversification of crops are discussed.

Economic position of the grape industry in Missouri, F. L. THOMSEN and G. B. THORNE (*Missouri Sta. Bul.* 273 (1929), pp. 34, figs. 18).—Price-production curves, supply-price curves, and coefficients of gross, partial, and multiple correlations are given showing the relation between Missouri farm price of grapes, Missouri and Arkansas grape production, American grape production, and California grape production. The competition between different types of grapes and different producing areas and the past and probable future trends in the grape industry are discussed. Tables are given showing the cost and labor requirements per acre of developing a vineyard and of producing grapes. The possibilities of increasing returns by improved marketing methods are also discussed.

The factors affecting prices received for Missouri grapes were found to be complicated, due to differences in methods of utilization, varieties, and production areas. The total United States production, including production both in California and in the Ozarks, affected the Missouri farm price, the general level being influenced most by California shipments and the year to year fluctuations by the variations in Ozark production.

The net cost per acre of developing a vineyard for the first three years on the basis of 82 records was found* to be \$138.63. Based on 40 records for vineyards without cover crops, the cost of production and return to grower per 4-qt. basket in 1926 were 16.33 and 14.56 cts., respectively. Based on 102 records for vineyards with and without cover crops, the net cost and return to grower were 17.03 and 14 cts., respectively, per 4-qt. basket.

The study indicates that the average grower can expect to break about even and at the same time provide an outlet for surplus family labor. Speculative plantings by nonfarmers using hired labor and rented land and equipment do not seem to be justified. An analysis of marketing costs indicates no possibility of any material reduction, except in some individual cases.

Flaxseed, T. O. MARVIN ET AL. (*Washington: U. S. Tariff Comm.*, 1929, pp. VII+64, figs. 3).—This is a report of the U. S. Tariff Commission to the President of the United States upon the investigation of the differences in costs of production, and other advantages and disadvantages in competition, of flaxseed in the United States and Argentina, the principal competing country. Included are the data obtained by the commission regarding the production of flaxseed in the two countries, imports into the United States, and prices; an analysis of the farm costs of producing flaxseed in the United States in 1925 and 1926; cost of handling in country elevators; cost of production in Argentina; marketing methods in the two countries; and the transportation charges to the principal United States markets.

The majority and minority reports of the commission are given, together with a proclamation of the President, May 14, 1929, increasing the duty on flaxseed from 40 cts. per bushel of 56 lbs. to 56 cts.

Milk and cream, T. O. MARVIN ET AL. (*Washington: U. S. Tariff Comm.*, 1929, pp. VII+74, pls. 2, fig. 1).—This is the report of the U. S. Tariff Commission to the President of the United States upon an investigation of the differences in costs of production, and other advantages and disadvantages in competition, of milk and cream in the United States and Canada, the principal competing country.

The information obtained in the commission's investigation regarding the dairy industry in the United States and Canada, imports of milk and cream, systems of fixing prices in the United States, items of farm costs of producing milk, and creamery costs of handling milk and cream is given, and the statistics of imports, prices, and costs of production of milk and cream are considered and analyzed.

The majority and minority findings of the commission are given, together with a proclamation of the President. May 14, 1929, increasing the duty on fresh milk from 2.5 cts. per gallon to 3.75 cts., and on cream from 20 cts. per gallon to 30 cts.

Farm real estate values in Ohio, H. R. MOORE (*Ohio State Univ., Dept. Rural Econ. Mimeogr. Bul. 15* (1928), pp. [1]+8, fig. 1).—This is a mimeographed report of a study made in cooperation with the Ohio Association of Real Estate Boards of the sale price and tax valuation of farm real estate from 1923 to 1928, inclusive. Tables are included showing for 22 counties the number of voluntary sales, acreage sold, average sale price per acre, tax valuation per acre, and the relation of sale price to tax valuation for the periods 1923–1926 and 1926–1928; the number of sales, acreage sold, average sale price per acre, tax valuation per acre, and the relation of sale price to tax valuation; and the average sale price per acre and the relative change, by years from 1923 to 1928, inclusive, in such prices for the State and for the four different sections of the State.

The average sale price for the State decreased from \$83.74 per acre in 1923–1926 to \$79.33 in 1926–1928, and the average tax valuation from \$70.03 to \$68.88, respectively. The indexes of farm real estate prices (1923=100) for 1928 for the several districts and the State were for the northwest section 82, northeast 82, southeast 100, southwest 84, and State 85.

Semi-annual index of farm real estate values in Ohio, Jan. 1 to June 30, 1929, H. R. MOORE (*Ohio State Univ., Dept. Rural Econ. Mimeogr. Bul. 19* (1929), pp. 10, figs. 4).—This mimeographed report, prepared in cooperation with the Ohio Association of Real Estate Boards, is based on data regarding 524 sales in 49 counties and supplements the report noted above.

The indexes of farm real estate prices for the first six months of 1929 were for the northwest district 77, northeast 82, southeast 95, southwest 90, and State 85. Tables and charts are included showing the indexes (1913=100) of farm product prices and farm real estate prices, 1880–1928, and of cash rent, 1900–1928.

Trends of tax levies in Oregon with emphasis upon rural and city real properties, W. H. DRESEN (*Oregon Sta. Bul. 257* (1929), pp. 46, figs. 15).—This study was undertaken with a view of (1) making a complete segregation of rural and city taxes for each county for the years 1910–1928, (2) showing the trends of tax levies on rural and city property, and (3) measuring these trends in terms of the pre-war purchasing power of the dollar. The principal sources of information were the annual summaries of the assessment and tax rolls as compiled by the county assessors of the different counties and filed with the State Tax Commission. Sales data were obtained from the State tax commissioner's office and the tax departments of the Southern Pacific and Union Pacific Railroads.

Tables are given showing for rural and for urban property, by counties and by years 1910–1928, the tax levies in mills on assessed values, on equalized values, on full cash values, and on sale values (1910 omitted). An analysis is made of the total taxes paid, levies in mills, and other data on the different bases to show the relation between rural and urban levies, the effect of rising taxes upon land values, the rural tax burden, the ratios of real property values to total property values, and the trends of tax levies in terms of pre-war dollars.

From 1910 to 1928, total rural taxes increased 218 per cent and total urban taxes 217 per cent. Of rural taxes, approximately 74 per cent fall on rural real property, and of urban taxes approximately 66 per cent fall on urban

real property, exclusive of public utilities property. From 1910 to 1928, the weighted average levies on rural taxable property increased from 14.16 to 35.93 mills on the equalized value basis, and from 10.02 to 21.23 mills on the full cash value basis. On the sale value basis (arithmetic average), the increase was from 8.91 mills in 1911 to 15.46 mills in 1928. For urban property, the weighted average levies increased from 22.97 mills in 1910 to 51.43 mills in 1928 on the equalized value basis, and from 16.26 to 30.40 mills on the full cash value basis. On the sale value basis, the increase was from 14.71 mills in 1911 to 28.82 mills in 1928. Assuming a 5 per cent investment basis, an average of from 13.70 to 16.00 per cent of the market value of rural land and from 23.83 to 21.35 per cent of the market value of urban land is absorbed by the present tax levy increases over the pre-war average levies. In the case of both rural and city taxes, approximately 50 per cent of the increases from 1910 to 1928 were found to be due to the depreciating value of the dollar.

The use, value, and cost of credit in agriculture, C. H. WEST (*California Sta. Bul.* 480 (1929), pp. 47, figs. 5).—This bulletin presents data and discusses how agricultural credit should be used; increased farm property values, commercialized production, and increased standards of living as reasons for increased use of agricultural credit; the amount of mortgage credit, short-term bank credit, and marketing and store credit used by agriculture and the decreasing cost of such kinds of credit; the importance of credit cost; and the reasons why credit costs vary.

A Philippine rural credit handbook, J. C. BALMASEDA (*Philippine Bur. Agr. Bul.* 45 (1928), pp. 278, pl. 1).—This handbook is designed primarily for those connected with the working of the rural credit associations of the Islands and those interested in the creation of a sound banking system on a small scale to help agricultural progress.

Included are a description of the development of agricultural credit in the Islands; a synopsis of the provisions and operation of the present rural credit law; questions and answers covering different phases of the present law; forms for articles of incorporation, by-laws, minutes, notes, mortgages, books, records, forms, etc.; opinions of the director of agriculture of the Philippine Islands on rural credit questions; and the text of the laws and circulars of the bureau pertaining to rural credit.

Wheat under the Agricultural Marketing Act: Some problems of the Federal Farm Board, A. E. TAYLOR ET AL. (*Wheat Studies, Food Research Inst. [Stanford Univ.],* 5 (1929), No. 9, pp. [1]+347-425, fig. 1).—Some of the problems of the Federal Farm Board created by the Agricultural Marketing Act of 1929 are discussed under the headings of scope and limits of "stabilization," defining the surplus of wheat, general considerations on organization and policy, costs and profits in carrying wheat, operative procedures, special problems of administration, and adjustment of supply to demand. Some general observations are also made.

Does Iowa "dump" its grain? G. S. SHEPHERD (*Iowa Sta. Circ.* 118 (1929), pp. 24, figs. 15).—This circular reports the results of a study of the monthly prices and shipments of corn in three areas of Iowa and of oats for the entire State for the years 1924 to 1928, inclusive. The percentages of the average shipments of corn made in the first six months after harvest were 40 in the 8 counties included in the eastern meat area, 50 in the 17 counties in the cash grain area, and 60 in the 18 counties in the western livestock area. Of the average shipments of oats for the State, 66 per cent were made in the first six months after harvest.

The reasons for the conditions existing for the two crops and the advisability of farmers holding the crops longer are discussed.

Farmers' produce markets in Ohio. C. W. HATCK (*Ohio Sta. Bul.* 443 (1929), pp. 46, figs. 7).—Included are descriptions of the relation to other markets, facilities, equipment, management, employees, space, rental, rules, and financial history of the farmer-owned markets of Akron, Cleveland, and Youngstown; and briefer descriptions of the farmer-owned markets of Newark, Portsmouth, and Warren; of the associations in Cincinnati and Toledo for marketing greenhouse vegetables; and of the municipal market situation in the State.

Preferences and practices in buying vegetables in Providence, Rhode Island. R. B. CORBETT (*Rhode Island Sta. Bul.* 220 (1929), pp. 69, figs. 22).—The data upon which this bulletin is based were chiefly from 152 questionnaires returned by housewives and from personal interviews with 21 housewives and 30 retailers. In compiling the data estimates were made of the percentage of the total population falling in each of five groups.

Tables are given and discussed showing for each group the percentages of orders for fresh vegetables given by telephone and of food costs going for fresh vegetables, and the size and frequency of purchases, average number of purchases per week, May–November and December–April, or during local season or out of season, percentage of total amount of demand in the city, and average price limits for lettuce, spinach, tomatoes, asparagus, sweet corn, celery, beets, carrots, potatoes, squash, string beans, and peppers.

The replies of consumers regarding quality demands and of retailers regarding preferences are briefly analyzed and discussed for each vegetable, and charts are presented and discussed showing the percentage of the population that would have continued to purchase the several vegetables at different prices and the high and low retail price quotations in the Boston market on the same day each week during 1926, 1927, and 1928.

Other tables and text present the data regarding other vegetables, the demand for new or little known vegetables and for a boiled-dinner bunch of vegetables, and comparisons of the various vegetables as to whether the demand was increasing, of purchases per week when in season, average percentage of changes in the weekly high and low quotations, average index of variability in such prices, and the coefficients of variation of the highest prices Providence consumers were willing to pay.

Economic conditions of farmers in Oklahoma as related to membership in the Oklahoma Cotton Growers Association. W. W. FERNOW (*Oklahoma Sta. Bul.* 186 [1929], pp. 23, figs. 10).—Data were collected by personal interviews during the winter of 1925–26 with 519 members and 336 nonmembers of the Oklahoma Cotton Growers Association in three sections of the State. Of the members 48 per cent were owners and 52 per cent tenants, and of the nonmembers 26 per cent were owners and 74 per cent tenants.

Tables, maps, and graphs are included and discussed showing for each area and for the areas combined the findings as to tenancy, stability, economic progress, and sources of farm income of the members and nonmembers and

owners and tenants. The averages for all districts are shown in the following table:

Facts regarding stability, economic progress, and sources of income of members and nonmembers of the Oklahoma Cotton Growers Association

	Members		Nonmembers	
	Owners	Tenants	Owners	Tenants
Years' stay on each farm.....	6	3.4	4.7	3
Changes in trading center.....	2.3	2.5	2.5	2.9
Age.....years.....	50	43.7	46.6	40.6
Years as farm operator.....	23.5	18.4	22	15.4
Net wealth, total, less inheritance.....	\$10,568	\$1,587	\$7,474	\$1,177
Net wealth, annual accumulation, less inheritance.....	\$375	\$69	\$299	\$59
Total investment operated.....	\$11,559	\$7,164	\$8,426	\$5,805
Value of real estate operated.....	\$9,908	\$6,217	\$7,281	\$5,014
Value of implements and machinery.....	\$563	\$273	\$309	\$217
Value of work stock.....	\$455	\$353	\$377	\$294
Value of milch cows.....	\$158	\$105	\$135	\$108
Value of other cattle.....	\$120	\$52	\$93	\$52
Value of hogs.....	\$69	\$51	\$50	\$52
Value of poultry.....	\$93	\$64	\$73	\$60
Crop acres per farm.....	112	86	100	72
Acres in cotton.....	60	55	51	47
Receipts from crop sales.....	\$1,635	\$1,048	\$1,427	\$1,014
Receipts from livestock and livestock products.....	\$339	\$158	\$262	\$122
Value of livestock and livestock products for family use.....	\$326	\$268	\$262	\$259

The Jewish co-operative movement in Palestine, H. VITELES (*Bul. Palestine Econ. Soc.*, 4 (1929), No. 1, pp. [8]+VIII+183, pls. 9).—The general characteristics and extent of the Jewish cooperative movement in Palestine and of the cooperative credit, agricultural, and producers' (except agricultural) societies are described. The texts of the Cooperative Societies Ordinance, 1920; the Debentures Ordinance, 1924; and the Companies' Ordinance, 1921-1925; and the register of cooperative societies in Palestine, January, 1929, are included.

[Report of the International Country Life Commission, 1929] (*Bul. Com. Internat. Embell. Vie Rurale [Bul. Internat. Country Life Comm.]*, No. 7 (1929), pp. XVI+184).—This publication includes lists of the officers and committees, the proposed constitution of the commission, and the opinions of the national committees as given at the third meeting of the commission, held at Budapest June 1-3, 1929 (*E. S. R.*, 56, p. 889; 59, p. 288). The questions and persons discussing them are as follows:

(1) What is the present organization for leadership in the improvement of rural life and what should be the future organization? United States, by C. J. Galpin (pp. 5-12); Germany (pp. 12-14); Luxembourg, by Pütz (pp. 14, 15); Belgium, by P. De Vuyst (pp. 16-18); Spain (pp. 18, 19); Switzerland (p. 19); Hungary, by J. Pogány (pp. 20-23) and E. Markó (pp. 23-28); and general report, by P. De Vuyst (pp. 28-35).

(2) How should academic and postacademic education for rural people be organized in regard to the improvement of country life? Belgium, by F. Graftiau (pp. 47-53); Luxembourg, by Pütz (pp. 53-55); Spain (pp. 56, 57); Switzerland (pp. 57, 58); Czechoslovakia, by E. Reich (pp. 58-71); Hungary, by J. Mitrovics (pp. 71-77) and F. de Czvetkovits (pp. 89-93); United States, by J. D. Willard (pp. 78-89); and general report, by de Lindequist (pp. 94-114).

(3) From the point of view of the improvement of rural life, what is there of importance in the present agrarian movements? United States, by B. Y. Landis (pp. 123-128); Germany (pp. 129-132); Luxembourg, by Pütz (pp. 132-134); Spain (pp. 134-139); Belgium, by A. Delos (pp. 139-144); Switzer-

land (pp. 144, 145); Czechoslovakia, by A. Prokeš (pp. 145-152); Hungary, by F. Marschall (pp. 152-161); and general report, by H. Beretta (pp. 161-165).

Appendixes include summaries in French of the opinions in other languages, a short article by A. Blaskovics on Hungary, and a statement of the fundamental principles for the general report on the second question, by de Lindequist.

Agricultural statistics, 1926, 1927, and 1928, R. J. THOMPSON [*Gt. Brit.] Min. Agr. and Fisheries, Agr. Statis.*, 61 (1926), No. 2, pp. 73-130; 62 (1927), Nos. 1, pp. 75; 2, pp. 77-132; 63 (1928), No. 1, pp. 77).—A continuation of the series previously noted (*E. S. R.*, 57, p. 387).

Part 1 (published as parts 1 and 2 previous to 1926) includes a report for the year on acreage and production of crops and number of livestock in England and Wales; tables showing the acreage and production of crops and number of livestock, number of workers employed on agricultural holdings, and number of agricultural holdings of different sizes in England and Wales; and a table showing the acreage, yields, and production of the principal crops in Great Britain and Ireland, Great Britain, and England and Wales for the preceding ten years.

Part 2 (previously published as part 3) includes a report on prices and supplies of agricultural produce and requirements, agricultural wages, and imports, and tables showing the prices of different agricultural products, feeding stuffs and fertilizers, and the amount of imports.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Agriculture for rural teachers, T. C. MCCORMICK (*New York: Macmillan Co.*, 1929, pp. XIV+388).—This is a textbook planned to meet the requirements in agriculture laid down by States for rural teachers' certificates, to give rural teachers and supervisors a clearer idea of the function of agriculture in rural and national life and a better understanding of the chief rural problems, and to set forth methods of teaching elementary agriculture. The several parts deal with the teaching of agriculture, the agricultural industry, principles of farm management, and scientific principles underlying plant and animal production. Each chapter is followed by a list of references and questions.

Outline of cotton fertilizer field projects on Coastal Plain and Piedmont soils of North Carolina for schools of vocational agriculture, C. B. WILLIAMS (*North Carolina Sta. Agron. Inform. Circ.* 33 (1929), pp. [1]+6).—The projects outlined aim to determine the main plant food needs, the best ratios, and the best ways of applying nitrogen for cotton on the various soil types.

Outline of fertilizer demonstrations with cotton in North Carolina for county agents, C. B. WILLIAMS (*North Carolina Sta. Agron. Inform. Circ.* 32 (1929), pp. [1]+6).—Simple field fertilizer demonstrations with cotton are outlined to show the optimum ratio and rate for the soil type, the best form of nitrogen, and how the recommended mixtures and quantities compare with those now in use.

Organic and food chemistry, G. E. CULVER and T. A. ROGERS (*Philadelphia: P. Blakiston's Son & Co.*, 1929, pp. VII+212).—This is a textbook for use in courses given to prepare students to teach domestic science.

Problems in home living, M. M. JUSTIN and L. O. RUST (*Philadelphia and London: J. B. Lippincott Co.*, 1929, pp. XIX+494, figs. 139).—This is a textbook for a one or two semester course in high schools. The unit-problem organization is followed, the three sections on family relationship and home management, health and home care of the sick, and child care and development each

being divided into five to seven units of three to eight problems each. Each unit is followed by a list of references and suggested readings.

A six-months' trial of the individual assignment in a ninth-grade clothing class, I. I. SELL (*Jour. Home Econ.*, 22 (1930), No. 1, pp. 9-15).—The methods used and the results obtained in the first trial of the individual-assignment method in the School of Agriculture (a 3-year vocational school admitting graduates from the eighth grade) of the University of Minnesota are described. The advantages and disadvantages peculiar to the method are discussed briefly.

FOODS—HUMAN NUTRITION

The carbohydrate content of foods.—Part I, The carbohydrate content of plant foods. Part II, The food value of vegetable carbohydrates, R. A. McCANCE and R. D. LAWRENCE ([*Gt. Brit.*] *Med Research Council. Spec. Rpt. Ser. No. 135* (1929), pp. 73).—Part 1 of this report contains hitherto unpublished data on the carbohydrate content of various fruits, nuts, and vegetables in terms of total reducing sugars, pentoses, and, in some instances, nonfermentable sugars calculated as glucose. From the mean of, in most cases, six independent analyses, the available carbohydrate is calculated by difference. Some of the materials were analyzed both raw and cooked. The total reducing sugars were determined by the Benedict method (E. S. R., 25, p. 15), pentoses by the McCance method (E. S. R., 56, p. 312), and nonfermentable sugars by the Benedict method after fermentation with yeast or by the MacLean blood sugar method (E. S. R., 41, p. 505).

Of the materials tested, those rich in starch or sugar, such as potatoes or apples, gave results agreeing with the older analyses, while the green vegetables gave much lower figures. These low results are thought to "explain the great vogue of green vegetables in the treatment of diabetes and the almost specific value attributed to them."

Part 2, by the senior author, consists of a critical review of the literature on the food value of vegetable carbohydrates other than starch and sugars, including fiber, hemicellulose, the furfural precursors (pentosans, etc.), and other hexosans. Of particular interest is a brief section on whole-meal bread—its use and abuse. The author's views on this subject are summarized as follows:

"In advocating whole-meal bread for general use, whether in times of need or in times of plenty, it should be remembered that not only men but also women and children are concerned, and that all the experiments on which the arguments are based have been carried out on animals or adult males. Children are very intolerant of high cellulose diets and for some brown bread is far too irritating, even if given with the idea of relieving constipation. Appetite is such an important factor in all digestive considerations that no one who dislikes a food of unproved value should be forced to eat it if it can be avoided. In time of peace of course the grown-up population, if they have the choice, will never eat whole-meal bread unless they like it, no matter how specious the advertisement, but they may force their children to eat it in the belief that they are doing them good. One should, therefore, be cautious in advising whole-meal bread generally, and wait until careful unbiased experiments have been done on a sufficient number of men, women, and children. Thus only can accurate conclusions be drawn."

Report of committee on standardization of experimental baking test, C. G. HARREL ET AL. (*Cereal Chem.*, 6 (1929), No. 4, pp. 249-310, figs. 17).—This annual report includes a restatement, with a few minor changes, of the standard experimental baking test proposed by Blish (E. S. R., 59, p. 591), and

individual reports by members of the committee on different phases of the work undertaken in the development of the test as follows: Reporting System for the Standard Experimental Baking Test, by M. J. Blish (pp. 253-258); Yeast Testing, by R. J. Clark (pp. 259, 260); Effect of Individual Molding upon the Bread Produced by the Standard Experimental Baking Test, by G. Moen (pp. 260-263); Relation of Supplement C to the Other Optional Methods of the Standard Experimental Baking Test (pp. 264-273) and Calibration of Loaf Measuring Apparatus (pp. 308-310), both by W. L. Heald; A Descriptive Analysis of the Collaborative Baking Tests of 1923-29, by C. G. Harrel (pp. 274-285); Statistical Analysis of Certain of the Collaborative Baking Tests, by C. H. Bailey (p. 286); Ovens, by C. G. Harrel and J. H. Lanning (pp. 286-300); Tests of Dough Thermometers, by R. C. Sherwood (pp. 301-303); Covered Fermentation Bowls, by A. A. Towner (pp. 303, 304); and Baking Pans, by L. D. Whiting (pp. 304-308).

Loaf volume as produced by different flours under prolonged fermentation, R. J. CLARK (*Cereal Chem.*, 6 (1929), No. 4, pp. 338-344, fig. 1).—The author is of the opinion that more valuable information may be secured on the baking qualities of a flour by baking several loaves, using different fermentation periods for each, than by the single-loaf test. In illustration, the results obtained with three different flours, a low grade, an 85 per cent patent, and a cut straight, are reported in a table and in curves, using the fermentation times as abscissas and the loaf volumes as ordinates. These curves all showed a major peak and sometimes one or two minor peaks. "It is believed that the major peak may represent the maximum baking ability of the flour and occurs when the proteins are properly conditioned. The minor peaks may be the points at which the trivalent phosphate salts pass first into the mono-acid and then the di-acid salts with their consequent effect on the flour proteins."

The food value of Hawaiian canned pineapple (*Hawaii. Pineapple Canneries' Sta. Bul.* 5 (1926), pp. 21, figs. 13).—This bulletin consists chiefly of reprints of papers by C. D. Miller on the content of vitamins A and B (*E. S. R.*, 51, p. 167) and C (*E. S. R.*, 55, p. 89) in fresh and canned Hawaiian pineapple, prefaced by a brief discussion of the chemical composition of Hawaiian canned pineapple. The analysis of a composite sample of both fruit and sirup of the mixed contents of six cans of Fancy sliced pineapple taken at random from the 1925 pack of six different canneries gave the following results: Moisture 76.01 per cent, sucrose 9.99, reducing sugars 12.31, protein ($N \times 6.25$) 0.44, crude fiber 0.30, ash 0.33, and fruit acids calculated as citric acid 0.59 per cent. From these figures it is calculated that the weight of a 100-calorie portion of canned pineapple of this quality would be 114 gm., which is equivalent to one slice of the usual size with its share of sirup.

Utilization of surplus prunes, E. M. MRAK and W. V. CRUESS (*California Sta. Bul.* 483 (1929), pp. 34, figs. 11).—The results of a three-year investigation conducted in the university fruit products laboratory and various factories to develop new and improve existing methods of utilizing prunes are presented in this publication. The principal new product developed is prune pulp or sieved prunes. The manufacture, preservation, distribution, composition, and uses of this product are described in considerable detail. Other products included are pitted prunes, canned ready-to-serve prunes in sirup, prunes canned or glass packed without sirup, and prunes canned in wine sirup. The utilization of prunes for alcohol, vinegar, acetic acid, or acetone is considered unprofitable, but prune pits can be utilized for the preparation of charcoal and oil. Formulas for the use of prune pulp in various ways are given in an appendix.

Physical traits of young children (*Amer. Jour. Diseases Children*, 38 (1929), No. 3, pp. 541-546).—This contribution from the Iowa Child Welfare Research Station of the University of Iowa consists of tables prepared by H. V. Garside of the means, standard deviations, probable errors, and coefficients of variation in metric units of the measurements of 150 boys and 167 girls from 3 to 6 years of age enrolled in the preschool psychological laboratories of the station from September, 1922, to April, 1928. The children were all in good health and belonged for the most part to families of the professional and merchant classes. The measurements were taken monthly on the date corresponding to the child's birthday by trained workers under the direction of B. T. Baldwin, following the technic developed by him (*E. S. R.*, 49, p. 662).

Recent work on the effects of inanition and malnutrition on growth and structure, C. M. JACKSON (*Arch. Path.*, 7 (1929), No. 6, pp. 1042-1078; 8 (1929), Nos. 1, pp. 81-122; 2, pp. 273-315).—This review supplements the volume previously noted (*E. S. R.*, 54, p. 692), covering the literature on the subject from 1924 to the time of writing, about the middle of 1928. The same general plan is followed as in the earlier work. A bibliography of over 700 titles is appended.

Metabolism of undernourished children, VIII, IX (*Amer. Jour. Diseases Children*, 38 (1929), No. 3, pp. 468-480).—Continuing the series previously noted (*E. S. R.*, 60, p. 892), two papers are presented.

VIII. The effect of high and low protein diets on the excretion of creatine, creatinine, and ammonia, C. C. Wang and M. Kaucher (pp. 468-475).—The data reported in this paper were obtained during the study of the effect of high and low protein diets on the nitrogen and caloric balances of undernourished children noted in the previous paper of the series, and include 40 experiments of a minimum of 3 days each on 8 normal and 10 underweight children between the ages of 4 and 12 years, all but 3 of the children being girls.

All of the children regardless of sex excreted creatine. In the normal children the output expressed as creatinine per kilogram of body weight amounted to 16.3 mg. on the high and 7.2 mg. on the low protein diet. For the undernourished children the figures were 18.5 and 8.2 mg., respectively. A fairly constant relationship was found to exist between the creatine and total nitrogen excreted, the value $\frac{\text{creatinine N}}{\text{total N output}} \times 100$ averaging 1.4.

The amount of protein had little influence on the creatinine output. The average values expressed as creatinine N per kilogram of body weight for the normal group were 6.6 mg. on the high protein and 6.5 mg. on the low protein diet, with corresponding figures of 7.1 and 7 for the undernourished group. The creatine output tended to decrease slightly and the creatinine to increase slightly with the age of the children. It is thought possible that this decrease may be due in part to a similar decrease in nitrogen intake and in part to an increased ability of the older children to metabolize this substance.

The ammonia excreted was higher per kilogram of body weight, but formed a lower percentage of the total nitrogen output on the high than on the low protein diet. On both diets somewhat larger quantities were excreted by the undernourished than the well-nourished children.

These results are thought to demonstrate no abnormality in the elimination of the waste products creatine, creatinine, and ammonia in undernourished children.

IX. A study of the basal metabolism, caloric balance, and protein metabolism during a period of gain in weight, C. C. Wang, R. Kern, and M. Kaucher

(pp. 476-480).—Twelve undernourished children, subjects in the previous studies of the series, were used during the period of returning to normal weight for determinations of basal metabolism, caloric balance, and protein metabolism.

"The results confirm our observations on different children of varying degrees of underweight, namely, (1) that the basal metabolism of undernourished children is apparently normal, (2) that the absorptive power of undernourished children is equal to that of normal children, and (3) that the retention of nitrogen in undernourished children is greater than that in children of normal weight, and as these children approach normal weight the retention of nitrogen decreases."

Precision and reliability of underweight measurement, C. E. TURNER (*Amer. Jour. Pub. Health*, 19 (1929), No. 9, pp. 969-979).—Various sources of error in the use of standard weight tables as an indication of malnutrition are discussed, with the general conclusion that they give average weight rather than normal weight and that it is "unscientific and unfair to set average weight as a goal for all children." It is emphasized, however, that the regular weighing of children in schools is important as an educational means of interesting them in health and health practices. It is thought that emphasis should be placed upon regular gains in weight rather than upon the child's underweight status. The failure to gain in weight over a period of several months should receive the attention of the teacher, nurse, or doctor.

"In the hands of the physician underweight is one of the valuable diagnostic factors. The separation of underweights in a school population for further medical attention may be a valuable screening process. That underweight in itself does not constitute a complete diagnosis is now becoming more widely recognized by the lay public. It would be extremely unfortunate if the data presented above were used to discredit either the scientific medical use of underweight or the practice of weighing children regularly in school as an educational procedure."

Dental caries: Influence of potential mouth acidity, C. MAGEE, C. L. DRAIN, and J. D. BOYD (*Soc. Expt. Biol. and Med. Proc.*, 26 (1929), No. 8, pp. 718, 719).—In order to determine whether the arrest of dental caries following the use of high mineral-high vitamin diets (E. S. R., 59, p. 893) might be due to changes in the potential acid-producing power of the oral flora, bacteriological studies, with H-ion concentration determinations, were made of scrapings from the gingival surfaces of the teeth of three children before, during, and at the completion of arrest of caries. In no case was there any significant change in the potential mouth acidity during the period of observation. A fourth child with no dental caries but with decalcification of the gingival enamel was also included in the study, with like results.

The effect of an exclusive meat diet on the chemical constituents of the blood, E. TOLSTOI (*Jour. Biol. Chem.*, 83 (1929), No. 3, pp. 753-758).—This is the complete report of one phase of the general investigation of the effects of an exclusive meat diet which has been noted from a preliminary report (E. S. R., 61, p. 589).

The effect of an exclusive meat diet lasting one year on the carbohydrate tolerance of two normal men, E. TOLSTOI (*Jour. Biol. Chem.*, 83 (1929), No. 3, pp. 747-752, figs. 2).—The two subjects of the investigation noted above were given glucose tolerance tests after both had lived for a year on an exclusive meat diet furnishing 120 gm. of protein and from 2,600 to 3,000 calories and later after a general diet. The tests made immediately after the discontinuance of the meat diet showed diminished tolerance to glucose as

demonstrated by the blood sugar curves of both men and glycosuria in one. After from two to four weeks on the general diet the blood of sugar curves became normal and the urine sugar-free.

In discussing these results, attention is called to the difference between them and those reported by Heinbecker for E-kimos (E. S. R., 61, p. 87). In the opinion of the author, the ability of the Heinbecker subjects on a practically exclusive meat diet to handle large quantities of carbohydrate was due to the formation of enough carbohydrate from the protein of their diet to keep the insulin-producing mechanism sufficiently stimulated to handle the carbohydrate. The interpretation of the present experiments and others along the same lines is "that the normal carbohydrate mechanism needs daily stimulation for good function. Should that stimulus be lacking, as is the case in low carbohydrate, high fat diets, and in prolonged fasting, it is temporarily incapable of handling large quantities of carbohydrate. In normal human beings this mechanism recovers fully after a general diet."

The distribution of vitamin A in some corn-milling products, C. R. MEYER and R. A. HETTLER (*Jour. Agr. Research* [U. S.], 39 (1929), No. 10, pp. 767-780, figs. 6).—Included in this complete report from the University of Illinois of the qualitative and quantitative study of the distribution of vitamin A in all of the by-products recovered from the wet-milling process for the commercial separation of cornstarch from whole yellow corn are flow sheets illustrating the general method for the separation of the different products and the distribution of vitamin A in the same milling products.

Of the principal milling products, gluten feed constituting 25.4 per cent of the whole corn and crude corn oil amounting to 3.4 per cent of the whole corn were good sources of A. Of the four components of the gluten feed (steep water, bran or reel slop, grits, and gluten) the gluten alone contained appreciable amounts, only 0.25 gm. daily being required to cure ophthalmia and produce normal growth. This indicates, as noted in the preliminary report (E. S. R., 62, p. 391), that vitamin A is concentrated in the endosperm of the kernel and that the concentration is greatest in that part of the endosperm lying next to the seed coats. Corn germs were found to contain very little and corn germ meal no vitamin A. The occurrence of vitamin A in appreciable amounts in the crude corn oil indicates that the small amount of vitamin A not found in the gluten is present in the oil of the germ and follows it on its removal from the germ. Refined corn oil was completely devoid of vitamin A.

A list of 23 references to the literature is appended.

The relation of carotin to vitamin A, T. MOORE (*Lancet* [London], 1929, II, No. 8, pp. 380, 381).—Preliminary experiments are reported which suggest the possibility that carotin, while not identical with vitamin A, may be the precursor from which the vitamin is formed in vivo. White rats on the Steenbock rachitic diet 2965 were fed for 36 days graded doses of carotin, from 0.0001 to 0.75 mg. daily, after which they were killed and the liver fats analyzed for carotin and for vitamin A by colorimetric and spectrographic methods.

It was noted first that although the largest amount of carotin was sufficient to color the whole rat intensely yellow if absorbed unchanged, the body fat was as colorless as that of the controls and the liver showed only feeble yellow pigmentation. On the other hand, an intense blue color was given with antimony trichloride and on spectrographic examination the absorption band was found to be at 610 to 630 μ , characteristic of vitamin A, rather than 590 μ characteristic of carotin. A comparison of the blue and yellow units

showed that in cases where the amount of carotin fed was below the minimal physiological dosage for vitamin A the blue units did not rise above those of negative controls, while in the case of all three rats receiving carotin in excess of the minimal dose higher values in the blue units were noted, with no corresponding changes in the yellow such as would have been the case if carotin had been stored unchanged.

Bacteria isolated from infections of the nasal cavities and middle ear of rats deprived of vitamin A. R. G. TURNER (*Jour. Infect. Diseases*, 45 (1929), No. 3, pp. 208-213).—Continuing the investigation noted from a preliminary report (E. S. R., 61, p. 292), the author has determined the toxicity for rabbits of Gram-negative and Gram-positive organisms from the nasal cavities, middle ears, and tongues of rats suffering from vitamin A deficiency. A fatal septicemia was produced by the Gram-negative cocci, apparently through the action of an endotoxin rather than a toxic substance secreted by the organism. The toxicity of Gram-positive organisms (*Staphylococcus aureus*) found in the same rats compared favorably with the toxicity of known strains of *S. aureus*.

As suggested in the earlier paper, Gram-positive organisms were encountered more frequently in the winter and early spring than in the summer.

The water-soluble vitamins of group B: The status of the question at the present time [trans. title], L. RANDOIN and R. LECOQ (*Bul. Soc. Chim. Biol.*, 11 (1929), No. 6, pp. 745-775; also in *Rev. Path. Compar.*, 29 (1929), No. 379-380, pp. 747-762).—This is a review and discussion of the literature on the subject. In the authors' opinion the vitamin B complex is made up of the thermolabile and alkali-labile antineuritic vitamin, the thermostable and alkali-labile vitamin B of nutritive utilization, the thermostable and alkali-stable vitamin of cellular utilization perhaps identical with bios and, provisionally, the antipellagric vitamin which is thought to correspond more closely to the vitamin of nutritive utilization than to the vitamin of cellular utilization. All of these with the exception of the antineuritic vitamin are thought to play a rôle in the utilization of carbohydrates.

A list of 121 references is appended.

Relation of vitamins B (B_1 , F) and G (B_2) to renal enlargement in rats fed high concentrations of protein. L. D. FRANCIS, A. H. SMITH, and T. S. MOISE (*Soc. Expt. Biol. and Med. Proc.*, 26 (1929), No. 8, pp. 725, 726).—In order to test the theory supported by various investigators, including Reader and Drummond (E. S. R., 56, p. 695), that the vitamin B complex is quantitatively related to the amount of protein in the diet and that the hypertrophy of the kidneys on high protein diets can be lessened by increased ingestion of vitamin B or its components, groups of from 12 to 14 rats, from some of which one kidney had been removed, were placed at 30 days of age on diets furnishing 18 and 90 per cent of protein. The groups were fed yeast at three different levels, and in addition the highest level of yeast was supplemented with autoclaved yeast and tikitiki extract, respectively, to furnish additional vitamin F or G. At autopsy the hearts and kidneys were weighed and the renal enlargement calculated on the basis of these weights.

Renal enlargement took place in all of the rats receiving the high protein irrespective of the amount of yeast alone or supplemented by additional vitamin F or G. This is thought to indicate that there is no quantitative relationship between the intake of protein and vitamins B and G.

Studies on growth.—Growth factors in liver. C. E. GRAHAM and W. H. GRIFFITH (*Soc. Expt. Biol. and Med. Proc.*, 26 (1929), No. 8, pp. 715-717).—In this preliminary report, data are summarized on the growth of young rats

on the fat-free diet of Evans and Burr (*E. S. R.*, 57, p. 791) with various supplements.

Rats on the basal diet alone did not survive. Survival but not growth resulted from the addition of 0.15 gm. of dried yeast to the basal diet and growth followed the further addition of autoclaved liver or yeast. The addition of 0.5 gm. of dried or autoclaved liver to the basal diet promoted good growth for from 20 to 30 days only. Growth was resumed following the addition of an extract of the antineuritic vitamin prepared by the Seidell method. This was interpreted as indicating that liver is rich in vitamin G, and that the limiting factor is vitamin F.

On the basal diet supplemented with liver or yeast, growth was still not equal to that on the stock diet. This is contrary to the results reported by Evans and Burr and also by Palmer and Kennedy (*E. S. R.*, 61, p. 597).

Vitamin requirements of nursing young.—VII, The production of uncomplicated vitamin-B deficiency in nursing young of the albino rat, B. SCRE and M. E. SMITH (*Jour. Nutrition*, 1 (1929), No. 6, pp. 537-540).—In continuation of the series of papers noted previously (*E. S. R.*, 61, p. 697), the authors have described the technic which they have developed for producing "uncomplicated vitamin B deficiency" (deficiency of the antineuritic vitamin) in the nursing young of white rats. The technic is essentially as follows:

On the birth of the litters the number is reduced to 6, and the mothers are transferred from the stock diet to a diet deficient in both B (F) and G (*E. S. R.*, 59, p. 491), supplemented with 500 mg. daily of dehydrated yeast administered separately. The mothers and the young are weighed daily, and if the young are not growing satisfactorily the yeast is increased to 750 mg. daily. After 14 or 16 days the ration is changed to one deficient only in the antineuritic vitamin by replacing 10 per cent of the dextrin with an equivalent amount of dehydrated yeast autoclaved for 6 hours at from 15 to 18 lbs. pressure and discontinuing the supply of dehydrated yeast to the mother. After this change the young first respond to vitamin G with renewed growth, but finally reach a state of prolonged maintenance, with development of posterior paralysis, labored respiration, cyanosis, and death unless vitamin B (F) is administered. The mothers lose weight rapidly, and after a time it is necessary to administer small doses of a concentrated extract of vitamin B (F) to keep them alive. If the ration is further modified by decreasing the amount of autoclaved dehydrated yeast to 5 per cent and the mother is allowed a supplementary daily portion of 750 mg. of the same yeast, the development of polyneuritis in the young is hastened. This is thought to indicate the presence of some vitamin B (F) in the autoclaved yeast.

On post-mortem examination the young rats suffering from this deficiency in vitamin B (F) all showed hemorrhages of the same character as those noted as resulting from a deficiency of the vitamin B complex (*E. S. R.*, 50, p. 894) and in addition severe hemorrhages in the vertebral column. In most of the young, hypertrophy of the heart was also noted. Other conditions noted were capillary congestion, hemorrhage and atrophy of the liver, progressive hypoglycemia, anhydremia, and constipation. Response to vitamin B (F) therapy was successful even in the advanced stages of the disease.

Quantitative studies of responses to different intakes of vitamin D, H. C. SHERMAN and H. K. STIEBELING (*Jour. Biol. Chem.*, 83 (1929), No. 3, pp. 497-504, fig. 1).—In this investigation young rats reared by mothers on the usual stock diet of the senior author's laboratory, consisting largely of two-thirds ground whole wheat and one-third whole milk powder, were transferred at the twenty-first or twenty-eighth day of age to a diet consisting of extracted

casein 18, Osborne and Mendel salt mixture 4, dry brewery yeast 10, sodium chloride 1, dried spinach 1, and cornstarch 66 per cent. Some, serving as negative controls, were kept on this diet alone; others, as positive controls, received in addition an abundance of vitamin D from a food source or from daily irradiation; still others were given during the experimental periods graded amounts of whole milk powder as the source of vitamin D.

In three series of rats weaned when 28 days old, the periods included the twenty-eighth to the fifty-sixth, the fifty-second to the eightieth, and the one-hundred and tenth to the one-hundred and sixty-sixth day of life, respectively, and in two series separated when 21 days old from the twenty-first to the fifty-sixth and from the fifty-second to the eightieth day, respectively. The gains in weight were determined weekly, and at the end of the experiment the femurs were dissected out, ashed, and analyzed for calcium by the Sherman-MacLeod modification of the McCrudden method (E. S. R., 54, p. 593). This determination was selected after a comparison of various criteria of calcification, including percentages of ash and calcium in the fresh femurs and in the dried extracted femurs and the ratio of ash to organic residue, had shown the same order of accuracy as judged by the ratio of the difference between the results of positive and negative controls to the probable error.

Practically normal calcification resulted when the basal diet was supplemented between the fifty-second and eightieth days of life with whole (summer) milk powder equivalent to from 6 to 7 per cent of the dry weight of the diet (.45 to .68 gm. of the basal diet), or from 8 to 9 per cent of the calories. Similar results were obtained when the diet was supplemented between the twenty-first and fifty-sixth days with somewhat more than 4 per cent of the milk powder (2.25 gm. of milk powder to 58 gm. of basal diet), or 5 per cent of the calories. The addition of smaller graded portions of milk resulted in graded improvements in calcification over the negative controls. Since the growth response and calcification were equally consistent in both groups, it is considered of advantage to have the experimental period begin immediately upon separating the young from the mother. "This procedure insures vigorous animals, and permits the 4- or 5-week experimental period to be terminated at an early age, thus making use of the period of most rapid deposition of calcium, as well as reducing the time and expense involved in experimental work."

Attempts to use limited growths as the criterion for the vitamin D content of foods as is done with the other vitamins were unsuccessful, as negative controls continued to gain during the experimental period. "Incidentally this is additional evidence that the test animals had considerable bodily stores of vitamin D, which in the case of families which had been for many generations on milk and wheat mixtures must have come from the milk consumed by themselves and their mothers, and that experiments on vitamin A conducted under the conditions employed in our laboratory were not vitiated by shortage of vitamin D even before the recognition of this latter factor."

Vitamin D and milk (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 18, p. 1386).—This editorial, emphasizing the value of milk as a source of vitamin D and minerals, is based chiefly on the paper by Sherman and Stiebeling noted above.

The increase in volume and in vitamin content of human and cow's milk by means of irradiated yeast [trans. title], M. WACHTEL (*München. Med. Wchnschr.*, 76 (1929), No. 36, pp. 1513-1515, figs. 9).—Data are reported showing an increase in milk production in cows through the addition of irradiated yeast to the winter ration and the enrichment of the milk in vitamin D as shown by feeding experiments on rats. A similar improvement in the quality of human milk was demonstrated following the administration of a proprietary product containing irradiated yeast.

Modern therapy for rickets (irradiated fresh and dried milk, activated ergosterol preparations) at the Basel Kinderklinik [trans. title], E. WIELAND (*Deut. Med. Wchnschr.*, 55 (1929), No. 31, pp. 1296-1298).—On the basis of experience for 4 years with various irradiated preparations in the treatment of rickets, the author emphasizes the following precautions: Irradiated ergosterol should never be administered for other diseases than rickets, and the maximum dosage should never exceed from 2 to 4 mg. of irradiated ergosterol, 80 to 85 gm. of irradiated milk powder, $\frac{1}{2}$ liter of irradiated fresh milk, or 5 drops of Vigantol in oil 3 times a day. The treatment should not be extended beyond 8 or 10 weeks.

New analyses of carbohydrate foods and their application to diabetic diets, R. D. LAWRENCE and R. A. McCANCE (*Brit. Med. Jour.*, No. 3579 (1929), p. 241).—This is a brief discussion of the significance in the planning of diabetic diets of the authors' recent analyses of carbohydrate foods as noted on page —. The separation of carbohydrates into physiologically available and unavailable has given much lower values for the physiologically available carbohydrates in fruits and vegetables than those generally used in dietary calculations. "In practice, therefore, diabetics may always be allowed large amounts of green vegetables, enough to satisfy the most voracious appetite. Moreover, it is quite unnecessary to boil vegetables three times, as was often done in the past, because they contain so little carbohydrate after ordinary domestic methods of cooking. It will be possible in future to make the carbohydrate content of diabetic diets more uniformly accurate, and consequently treatment, and especially experimental therapeutic investigations, may be made more accurate also."

HOME MANAGEMENT AND EQUIPMENT

Use of time by Oregon farm homemakers, M. WILSON (*Oregon Sta. Bul.* 256 (1929), pp. 71, figs. 32).—Records obtained in 1926 and 1927 for a "typical" week from 288 farm home makers are analyzed. Tables and graphs are presented and discussed showing the total hours spent per week in home making and other work, distribution of time devoted to home making, time spent on farm work and the distribution of personal time; the amount, sources, and kind of help received; and the size and composition of the household, season, the house and its equipment, use of commercial services, location of the home, and the schooling of the home makers as factors affecting the use of time by home makers. Records were also obtained from 71 country nonfarm and 154 noncountry nonfarm home makers. The results of these are used for comparative purposes, the main object in including them in the study being to describe an alternative situation for the farm home makers.

The average work period per week was found to be 63.7 hours for farm home makers and 60.7 and 54.8 hours, respectively, for country nonfarm and noncountry nonfarm home makers. The time spent in home making was 51.6, 54.8, and 51.5 hours per week, respectively, for the three groups. Of the total work time of the farm home makers, 81 per cent was spent in home making, 18 per cent in farm work, and 1 per cent in other work. For 9 per cent of the farm home makers, the weekly work period was less than 50 hours, and for 14 per cent it was 75 hours or more. Of the 51.6 hours spent in home making by farm home makers, 47 per cent was devoted to food activities, 18 per cent to the house, 22 per cent to clothing and textiles, 7 per cent to care of the family, 3 per cent to management, and 2 per cent to other activities. The average of 102.7 hours of personal time per week of farm home makers was

divided as follows: 61 per cent for sleep and rest, 14 per cent for physical care of self, 23 per cent for leisure activities, and 2 per cent for other activities. Reading and informal social life were of about equal importance and together accounted for more than half of the leisure time.

The help in household duties received by the farm home makers averaged 9.5 hours per week. Differences in household requirements due to differences in ages of children or the number of persons served were associated with variations both in length and distribution of work periods of home makers. Seasonal variations in farm work were the chief cause of the variations in the work period of farm home makers. Such home makers having both modern plumbing and electricity spent 3 hours per week less on meals, cleaning, and washing than did those without these conveniences. The home makers with more schooling devoted more time to the care of their children and more of their leisure time to meeting and study and to work for organizations. Farm and nonfarm home makers were found to follow the same time-pattern in caring for household needs.

The importance of the use of time by farm home makers is discussed.

This study was made in cooperation with the U. S. D. A. Bureau of Home Economics.

Organization of the sewing center in the home, E. M. CUSHMAN (*New York Cornell Sta. Bul.* 492 (1929), pp. 37, figs. 17).—This publication contains the report of studies conducted in nine homes in the State to determine the customary arrangement of equipment used in sewing and methods of improving existing arrangements. The plan followed consisted in tracing with a ball of twine all of the steps taken in assembling and putting away the equipment. In the first three of the nine studies records were also kept of the time spent. In each case rearrangements were suggested, based upon the lines of travel and the floor plans of the house, and later the whole process was gone through with again to determine the energy saved.

It was found that the greatest saving could be made by centering the processes in one room and using a sewing cabinet. Such a cabinet provided with all the necessary equipment is described and illustrated.

MISCELLANEOUS

List of available publications of the United States Department of Agriculture, June 1, 1929, compiled by J. O. RILEY (*U. S. Dept. Agr., Misc. Pub.* 60 (1929), pp. IV+71).—This contains a list, alphabetically arranged and classified by subjects, of the available publications of the Department, together with a description of the nature and scope of the different series and of the various periodicals.

Forty-eighth Annual Report of the New York State Agricultural Experiment Station, [1929], U. P. HEDRICK (*New York State Sta. Rpt.* 1929, pp. 78).—This contains the organization list, a review of the work and publications of the station, and a financial statement for the fiscal year ended June 30, 1929. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

NOTES

Massachusetts College and Station.—The department of animal and dairy husbandry has been divided into departments of animal husbandry and dairy industry, each including teaching, research, and extension functions and in charge, respectively, of V. A. Rice and J. H. Frandsen. Enos J. Montague, head of the farm department and assistant professor of farm practice, has been appointed head of the farm department and assistant professor of animal husbandry. The plan provides for the development and management of the flocks and herds on the college farm from the joint viewpoints of efficient farm management and adequate provision of illustrative material for teaching.

A horticultural manufactures building, a two-story edifice of 25 rooms, has been completed. Among other features it contains a large manufacturing room, 77 by 20 ft., equipped with steam jacket kettles, vacuum pans, steam pressure cookers, a cider mill, a cyclone pulper, water baths, a carbonating outfit, a drying outfit, a dumb-waiter, and high temperature processing apparatus. In construction and equipment it is believed to be a unique structure.

Michigan Station.—The resignations are noted of H. M. Wells, superintendent of the Graham Horticultural Substation at Grand Rapids, and Dr. J. E. Kotila, research assistant in plant pathology. The latter resignation is effective February 1 and is occasioned by the acceptance of a position in the Office of Sugar Plant Investigations of the U. S. Department of Agriculture.

Nevada Station.—The department of range management, which is conducting cost of production studies on cattle ranches in the State, is issuing periodical news bulletins to cooperating ranchers. These bulletins give the individual and average cost of various operations on ranches studied. It was found that this procedure establishes contact between cooperating parties and promotes management efficiency.

New York State Station.—An appropriation of \$285,000 has been granted for the much-needed horticultural laboratory building, and it is expected that construction will be begun during the coming season. A three-story brick building is contemplated, which will house the divisions of horticulture and botany.

Other appropriations for the next fiscal year aggregate \$330,650, an increase of \$11,740.

South Dakota College.—The campanile with its chimes, donated by an alumnus of the institution, Charles Coughlin of Milwaukee, Wis., has been completed and dedicated, adding greatly to the beauty of the campus of the institution. It is stated that the campanile is the highest tower in the State of South Dakota and compares favorably with the best constructed in the United States.

Federal Soil Erosion Projects.—According to a recent announcement in *Agricultural Engineering*, field and laboratory studies in soil erosion are to be conducted cooperatively for the U. S. Department of Agriculture by the Bureau of Public Roads, the Bureau of Chemistry and Soils, and the Forest Service.

Soil erosion experiment stations are to be located in the principal erosion regions in the United States. As a result of a preliminary reconnaissance survey already made, 18 such regions have been outlined. The first station

to be established has been located in the red land region of Oklahoma and Texas, near Guthrie, Okla., where work has been in progress since early in 1929 and is conducted in cooperation with the Guthrie Chamber of Commerce. A second station is located near Temple, Tex., in the black lands region, where work has been in progress since April, 1929, in cooperation with the Texas Experiment Station. For a third station a location has been chosen on the dark prairie lands at the Kansas Substation farm, near Hays. Field examinations have been made for the purpose of locating stations in the gray lands of northern Missouri and southern Iowa, and in the light-colored sandy lands of southwest Arkansas, northeastern Louisiana, and east-central Texas. Other stations will be established in the southern Piedmont lands of Virginia, North Carolina, South Carolina, and Georgia, and in the northern Piedmont lands of New Jersey and Pennsylvania.

American Society of Animal Production.—The 1929 meeting of this society was held in Chicago on November 29 and 30. The meeting was generously attended, and keen interest was shown in the many papers presented on its well-organized program. The designation of some individual to discuss each paper was attempted in most cases with much success. The facts brought out in this way and in the general discussions often supplemented the original papers in a very valuable way.

The opening session was devoted to the business side of livestock farming and included the presidential address of H. J. Gramlich, as well as papers relating to Physical Factors in Livestock Economics, by E. L. Potter; Acre Returns as Compared with Animal Returns, by P. Gerlaugh; Cooperation, An Essential to Success in Handling the Business Side of Any Industry, by E. W. Sheets; and Intensive Pasture Management under the Hohenheim System, by E. J. Montague. Luncheon sessions followed for sections on cattle, horse, sheep, and swine, with five-minute papers pertaining to the results of production studies, including both feeding and breeding experiments.

One general session was devoted to the teaching of animal husbandry, the following papers being presented: The Value of Personal Contact Between Instructor and Student, by H. H. Kildee; Methods of Teaching Animal Husbandry to College Students, by Dr. F. S. Hultz; Extension Teaching Methods, by R. Beresford; The Science of Teaching Livestock Judging, by J. S. Coffey; What Effect Does High School Instruction in Animal Husbandry Have on Performance in College? by L. J. Horlacher; and The Use of the Score Card in Teaching Livestock Judging, by H. W. Vaughan. Interest in this section was particularly keen, and in addition to methods of teaching extended to the subject matter and duplication between courses.

Of particular interest in the genetics section was a paper by Dr. F. F. McKenzie on The Anterior Lobe of the Pituitary and Livestock Breeding. Preliminary results of the effects of the hormone of the anterior lobe of the pituitary were found to show a remarkable increase in the number of ova matured at a single ovulation period in swine.

In the extension section special attention was given to projects with cattle, sheep, swine, horses, and the general methods of conducting livestock extension work. At a special meats luncheon the progress in the national cooperative study of Factors Influencing the Quality and Palatability of Meats was discussed by E. W. Sheets, K. F. Warner, Miss L. M. Alexander, F. G. King, Dr. C. R. Moulton, M. D. Helser, and R. C. Pollock.

The business meeting was largely taken up with the reports of committees. Of particular interest to experiment station workers was the report of the committee on methods of investigations, of which Dr. G. Bohstedt is chairman.

This committee made four recommendations concerning feeding experiments, namely: (1) In the cases where individual gains are not reported the standard deviation should be given; (2) in cases of aberrant results special search should be made for the positive factors; (3) detailed descriptions of the character of the feeds used should be given; and (4) in cases of studies of advantages from grinding feeds the degree of fineness of the ground feed should be stated, the modulus method being recommended.

Considerable discussion on the classification of livestock marketing as a subject for inclusion in the animal husbandry and agricultural economics departments in teaching followed the presentation of the report of the committee on methods of instruction by Dr. C. W. McCampbell. The committee report proposed a guide curriculum for animal husbandry which is to receive the society's consideration with final action at the next annual meeting.

Much discussion also followed the report of the committee on mixed feeds, mainly on account of a resolution presented by Dr. E. B. Forbes at the conclusion of a paper entitled *The Inclusion of Salt and Other Mineral Components in Mixed Feeds*. Dr. Forbes indicated that there was no evidence that milch cows in the United States as a whole need mineral supplements except salt, and he therefore recommended that the society disapprove the employment of such supplements as components of mixed feeds. Final action on this proposal was delayed until the results of further investigations are available.

For the ensuing year J. R. Wiley of Indiana was chosen president and Dr. McCampbell vice president. Dr. W. E. Carroll of Illinois was reelected secretary-treasurer.

At the annual dinner of the society, held following the meeting, the outstanding member selected for special honor was Dr. Andrew Boss. In the talks given by W. H. Tomhave, Dean W. C. Coffey, and A. J. Glover, it was pointed out that Dr. Boss had been successively farm foreman, agronomist, animal husbandman, and vice director at the Minnesota Experiment Station, and that he was instrumental in starting the first meats course in any agricultural college. In responding, Dr. Boss stated that in the course of his 40 years' efforts in college work he had endeavored to develop a measuring stick for meat animals and contribute fundamental knowledge along animal husbandry lines, especially such as were related to animal breeding.

As is customary, the winning student judging team of 1929, which was from Purdue University, was presented by Dr. J. H. Shepperd. The prizes for the Saddle and Sirloin Club essay contest on the subject *The Eye of the Master Fattens the Cattle* were distributed, and the subject for next year's contest was announced as *Cost Accounting on the Livestock Farm*.

Ninth International Horticultural Congress.—This congress is to meet in London from August 7 to 15 under the auspices of the International Committee for Horticultural Congresses and by invitation of the Royal Horticultural Society. Addresses are scheduled for three days and will be divided into three main groups of propagation, pomology, and botanical gardens and general subjects. The remainder of the time will be largely devoted to excursions to private and commercial gardens, nurseries, and similar establishments, the gardens of the Royal Horticultural Society and the Royal Botanic Gardens at Kew, the Rothamsted Experimental Station and the research stations at East Malling, Cheshunt, and Long Ashton, and the John Innes Horticultural Institution. There will also be a special horticultural exhibition on August 14 and 15.

EXPERIMENT STATION RECORD

VOL. 62

APRIL ABSTRACT NUMBER

No. 6

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Textbook of agricultural chemistry.—II, Fertilizer materials. III, Soil science. IV, Feeding stuffs, edited by E. HASELHOFF and E. BLANCK (*Lehrbuch der Agrikulturchemie. 2. Teil, Düngemittellehre. 3. Teil, Bodenlehre. 4. Teil, Futtermittellehre. Berlin: Borntraeger Bros., 1928, vols. 2, pp. VIII+216; 3, pp. [7]+208, figs. 3; 1929, vol. 4, pp. VIII+216*).—This textbook, of which the first volume, dealing with the science of plant nutrition, has already been mentioned (E. S. R., 58, p. 9), is completed in the three volumes here noted.

Volume 2, by Haselhoff, contains two parts, of which the first, consisting of but two chapters, deals with the fundamental principles of fertilization and with the ascertaining of the fertilizer needs of the soil, while the second section takes up the individual types of fertilizer material in detail.

Volume 3, by Blanck, takes up in the first, or general part, soil materials and soil formation, the second part being concerned with the existing properties and activities of the soil and with influences affecting them.

Volume 4, by Haselhoff, covers its subject under the following captions: The fundamentals of present day animal nutrition, with a brief review of the development of the science; the constituents of feeding stuffs, their composition and significance for animal nutrition; the composition and digestibility of feeding stuffs under various influences; and the production, fodder value, and applications of feeding stuffs.

Throughout its four volumes the book has the avowed purpose of adhering strictly to the practical aspect, avoiding such theoretical considerations as have no immediate significance in connection with practice in the various fields of agricultural chemistry discussed.

The preparation and properties of vitamin C concentrates from lemon juice, D. P. GRETTE and C. G. KING (*Jour. Biol. Chem.*, 84 (1929), No. 2, pp. 771-776).—A vitamin C concentrate prepared according to the method of Zilva (E. S. R., 57, p. 488) from a liter of lemon juice was dried for an hour at 50° C., partially dissolved in 15 cc. of absolute ethyl alcohol, saturated with dry hydrochloric acid, allowed to stand at room temperature for 15 hours, and then distilled in vacuo at 50° for 90 minutes, after which the receiver was changed and the temperature slowly raised through a period of 150 minutes to 250° and held at that temperature for 30 minutes. The distillates obtained at both temperatures showed no vitamin C activity, and the residue

from the 50° distillation had practically the same activity as the original lemon juice when tested by the method of Sherman, LaMer, and Campbell (E. S. R., 40, p. 865).

The observation that butyl alcohol extracts the yellow color and wax from lemon juice and that the yellow color accompanies the active phase during the decitration and precipitation procedure of Zilva suggested the possibility that vitamin C might be soluble in butyl alcohol. The extraction of 100 cc. of lemon juice successively with 20-, 10-, and 10-cc. portions of butyl alcohol failed to remove any appreciable amount of vitamin C, but did remove approximately 0.33 mg. per cubic centimeter of fatty material. This was made use of in a new method of obtaining vitamin C concentrates from lemon juice, the various steps in the procedure being essentially as follows:

The juice is decitrated with basic lead carbonate instead of with chalk as in the Zilva method. After stirring slowly until the evolution of carbon dioxide has ceased (2 or 3 hours) and cooling, the crystalline precipitate is filtered off and the filtrate, without concentration or alcohol treatment as in the Zilva method, is fermented with Fleischmann's yeast. This requires about 24 hours, but may be hastened by adding a few drops of 20 per cent phosphoric acid and centrifuging before the yeast is added. After the fermentation is complete, the yeast is centrifuged out and 17 cc. of a saturated solution of neutral lead acetate added to each 100 cc. of the decitrated juice. The white inactive precipitate is removed by centrifuging, the filtrate brought to a pH of 7.2 to 7.4 with dilute ammonia, and the active precipitate removed by centrifuging. This is dissolved in dilute acetic acid, made up to half the original volume with water, and the precipitation with ammonia repeated. The second precipitate is treated with excess dilute hydrochloric acid, which converts the yellow lead precipitate to white lead chloride, and is then extracted three times with 10-cc. portions of butyl alcohol which precipitates the waxy matter. Sufficient ethyl alcohol is then added to bring the alcohol concentration to 90 per cent, the precipitated lead chloride is removed, and the filtrate is evaporated to dryness and made up to one-fifth the original volume of the lemon juice with water containing traces of acetic acid.

The extract as thus prepared was found to retain practically all of the anti-scorbutic value of the original lemon juice. In an attempt to purify it still further, acetone was added to a concentrated water solution of the extract. By precipitating the ammonium chloride present, this reduced the total solids from 0.5 to 1 mg. per cubic centimeter of lemon juice equivalent. The filtrate from this precipitation was carefully dried in vacuo and the dried material extracted with 50 cc. of absolute acetone for 24 hours. Activity tests showed that the active material is definitely soluble in absolute acetone. Analyses of the extract gave a content of 0.38 to 0.6 mg. of total solids per cubic centimeter of lemon juice. Total nitrogen constituted 3.46 per cent, ammonia nitrogen 1.9, and reducing sugars as dextrose 19 per cent of the total solids.

"The final active material gave a faint carbylamine test for amino nitrogen, reduced potassium permanganate and ammoniacal silver nitrate quickly, and gave a faint coloration with ferric chloride. Bromine water produced a slight cloudiness. The phthalic anhydride and Liebermann reactions for phenols were too faint to be considered positive. Further extraction of the dried acetone-soluble material with absolute ethyl ether, in which the vitamin is practically insoluble, reduced the total active solids to 0.28 mg. per cubic centimeter of lemon juice."

On the photochemical reactions of ergosterol, E. H. REERINK and A. VAN WILK (*K. Akad. Wetensch. Amsterdam, Proc.*, 32 (1929), No. 7, pp. 845-848,

figs. 3).—In the opinion of the authors insufficient attention has been paid to the influence of the wave length used for the irradiation of ergosterol for the synthesis of vitamin D. By the use of suitably selected light sources and filters they have irradiated ergosterol dissolved in hexane in a quartz tube and have studied the progress of the reaction at different wave lengths by determining the absorption spectra of the liquid. Feeding experiments to be reported later were conducted by J. W. R. Everse and J. van Niekerk with the various products. From the two series of observations, the authors conclude that with the use of radiations of wave length between 300 and 270μ about 60 per cent of the ergosterol can be converted into vitamin D without the formation of by-products, but that with the use of radiations of wave length 254μ it is impossible to obtain a yield of more than 15 per cent and the formation of by-products can not be prevented. The product obtained by radiations of the longer wave lengths crystallized in lozenge-shaped transparent plates melting below 0° C. to a colorless vitreous mass.

Studies in the metabolism of aluminium.—I, Method for determination of small amounts of aluminium in biological material, F. P. UNDERHILL and F. I. PETERMAN (*Amer. Jour. Physiol.*, 90 (1929), No. 1, pp. 1-14, *fig. 1*).—Following a brief summary of the present status of belief concerning the occurrence of aluminum in foods and its possible deleterious effect upon health, the method which has been developed by the authors for the determination of aluminum in blood and tissues is described, with a discussion of its accuracy, scope, and limitations. The method, which is based upon the reaction of alizarin with aluminum to form a red compound alizarin lake, is said to be capable of determining amounts of aluminum between 0.0005 and 0.005 mg. and with suitable modifications and extreme care amounts as low as 0.00025 mg., and to be applicable to biological materials of various kinds.

A method for determining the color of agricultural products, D. NICKERSON (*U. S. Dept. Agr., Tech. Bul.* 154 (1929), pp. 32, *figs. 18*).—"Methods of color measurement may be principally referred to as methods of measuring color and methods of measuring the color stimulus. One method is psychological, the other is physical; and elements of the two may be combined in what may be termed psychophysical methods. The method used in the work described in this bulletin comes under the third head, but it is interpreted in terms of the first. All methods of spectrophotometry and many methods of colorimetry come under the second. In general, methods of colorimetry may come under any of the three heads.

"Color measurement of agricultural products is a distinct necessity, not alone for purposes of standardization but for determining the importance of color as a factor of their utility and value and for correlations with other factors which are important."

An outline of the general theory of color measurement, the specific theoretical considerations involved in the method here proposed, the apparatus used, its manipulation, and the calculation of the results, are taken up, with illustrations from work on hay and cotton colors.

A comparison of the bromthymol blue milk test and the methylene blue reduction test for determining quality of milk, E. D. DEVEREUX (*Jour. Dairy Sci.*, 12 (1929), No. 5, pp. 367-373).—A comparison of the bromthymol blue milk test and the methylene blue reduction test for determining the quality of milk was made at the Michigan Experiment Station with 150 samples of milk. The bromthymol blue test graded milk fairly accurately into a large number of classes according to keeping quality. The reduction test fluctuated more but graded milk into four classes equally as accurately. A correlation coefficient of 0.77 was found between each test and the keeping quality of the milk.

A comparative investigation of certain film-forming fungi, M. A. JOSLYN and W. V. CRESS (*Hilgardia* [California Sta.], 4 (1929), No. 9, pp. 201-240, figs. 5).—Of the 21 organisms studied 16 were *Mycodermas* from the surface of olive, pickle, and other brines and of fermenting or fermented apple juices and from California grapes; one of the organisms was a pink *Torula* species from the soil of a cucumber field; of the 4 remaining forms 3 were *Penicillium* forms from brines, and the fourth a *Mucor* from moldy cucumbers. The primary purpose of the investigation was a comparison of the principal morphological and cultural characteristics of the various organisms.

From among a large number of recorded observations the following may be noted: Macroscopic resemblances among the *Mycodermas* were rather close, but in microscopic detail marked differences appeared. The molds and the strain of *Torula* were typical in appearance for the genera represented. The organisms retained their original characteristics even after prolonged growth in various media.

All of the organisms grew in nutrient sucrose, dextrose, maltose, lactose, mannite, glycerin, acetic acid, citric acid, lactic acid, malic acid, oxalic acid, and tartaric acid, in most cases without visible gaseous fermentation. Of the acids, citric was most suitable to the development of the molds, lactic acid to that of the *Mycodermas*. Oxalic acid proved the most toxic of the acids, acetic acid less so than had been expected. Several of the *Mycodermas* grew in relatively high concentrations of acetic acid; 4 types grew in 0.28 N acetic acid, of which the pH value is given as 3.5. In salt solutions some of the organisms were capable of growth at a concentration of 20 per cent, although most were inhibited by 15 per cent. The effect of salt was found interdependent, however, with the pH value and other factors affecting growth. The thermal death point of such of the organisms as were examined in regard to this characteristic was found to be influenced by the pH value of the medium, the salt concentration, and the quantity of the inoculum.

Sodium benzoate, sulfur dioxide, and hydrofluoric acid were found the most efficient and practicable antiseptics for factory use, but the organic acids and salt were required in quantities too large for practical purposes. The toxicity of the antiseptics named, that of sodium benzoate especially, increased with increasing salt and acid content.

The *Mycodermas* studied were classified into three groups and into seven varieties.

METEOROLOGY

The practical importance of climatic cycles in engineering, A. STREIFF (*U. S. Mo. Weather Rev.*, 57 (1929), No. 10, pp. 405-411, figs. 7).—Reviewing the evidence regarding climatic cycles and ancient and recent changes in climate, the author states that "the amplitudes of recurring cycles are generally considered too small to be of any importance" but that while "recent climatic changes have too small amplitudes to be of any importance in forecasts of weather, due to the cumulative as well as amplifying nature of stream flow they are of great importance in hydraulic engineering."

A considerable bibliography of the subject is given.

The fruit-frost work of the Weather Bureau in the upper San Joaquin Valley, C. C. ALLEN (*U. S. Mo. Weather Rev.*, 57 (1929), No. 10, pp. 424, 425; *also in Bul. Amer. Met. Soc.*, 10 (1929), No. 12, pp. 224-226).—The frost-warning service, which has been in operation for several years in the upper San Joaquin Valley of California, is briefly described. This service is carried on by the Weather Bureau in cooperation with county farm advisors, and is stated to

have shown that frost forecasting "is entirely feasible and of undoubted value to the territory served."

Monthly Weather Review, [September-October, 1929] (*U. S. Mo. Weather Rev.*, 57 (1929), Nos. 9, pp. 361-404. pls. 14, figs. 24; 10, pp. 405-447, pls. 10, figs. 15).—In addition to detailed summaries of meteorological and climatological data and weather conditions for September and October, 1929, and bibliographical information, notes, abstracts, and reviews, these numbers contain the following contributions:

No. 9.—The Tephigram—Its Theory and Practical Use in Weather Forecasting (illus.), by C. M. Alvord and R. H. Smith (pp. 361-369); Sources of Local Water Supply (illus.), by A. Sonderlegger (pp. 369-374); Agricultural Meteorology and Raising the Agricultural Productivity, by A. Kaigorodoff (pp. 374, 375) (*E. S. R.*, 62, p. 313); Weather Abnormalities in United States, V, by A. J. Henry (pp. 375, 376); A Mobile Fire Weather Forecast Unit, by L. G. Gray (pp. 377, 378); and The Record of Evaporation Stations in California, by E. E. Eklund (pp. 378-381).

No. 10.—The Practical Importance of Climatic Cycles in Engineering (illus.), by A. Streiff (pp. 405-411) (see p. 504); Radiation and Temperature of the Sun (illus.), by W. E. Bernheimer, trans. by W. W. Reed (pp. 412-417); The Tropical Cyclone of September 18-October 4, 1929, by C. L. Mitchell (pp. 418-420); The September 28, 1929, Tornado in Fort Lauderdale, Fla., by G. B. Hills (pp. 420, 421); The Status of Climatology of the Ages, by M. Manson (pp. 421-423); Psychrometric Observations, by M. Corecque (p. 423); The Fruit-Frost Work of the Weather Bureau in the Upper San Joaquin Valley, by C. C. Allen (424, 425) (see p. 504); Weather Forecasts in Relation to the Marketing of Citrus Fruits, by F. D. Young (p. 425); and California Snow Surveys, by H. M. Stafford (pp. 426-428).

Climatological data for southern South America, W. W. REED (*U. S. Mo. Weather Rev. Sup.* 32 (1929), pp. III+23, fig. 1).—This paper summarizes in detail data for temperature and precipitation and describes the varied climatic conditions of Paraguay, Uruguay, Chile, Argentina, and the adjacent areas, Juan Fernandez Islands, Falkland Islands, South Georgia, and South Orkney Islands. The more important sources of information on the subject are cited.

SOILS—FERTILIZERS

Comparisons of daytime and nighttime soil and air temperatures, A. SMITH (*Hilgardia* [*California Sta.*], 4 (1929), No. 10, pp. 241-272, figs. 14).—Comparative determinations of the temperature fluctuations in the air at a height of 4.5 ft. and in the soil at depths of 0.5, 3, 6, 12, 24, and 36 in. were made in an area kept free from vegetation and not irrigated, with a view to the recording of maxima, minima, and averages for a day period, sunrise to sunset, and for a night period, sunset to sunrise. The terms of the experiment were February 20 to September 30, 1925, and January 1 to June 21, 1927. Similar work, employing like methods but relating the data to 24-hour periods, has already been noted (*E. S. R.*, 61, p. 418).

The possible significance of such temperature fluctuations as were followed in the present series of measurements is briefly discussed, the methods and equipment are described, and the results are reported both numerically and in the form of a number of curves illustrative of the general tendencies of day and night minima, maxima, and averages at various depths in the soil and for each of the two terms of the experiment.

At the 0.5- and 3-in. levels the day temperatures were higher than the night temperatures, but at the 6- and 12-in. depths the night temperatures averaged

higher than those of the daylight periods in the 1925 series of measurements. At the depths of 24 and 36 in. there was no regular rise and fall of temperature during the 24-hour period.

Soil problems of the Wheatland project, T. J. DUNNEWALD (*Wyoming Sta. Bul. 168 (1929), pp. 48, figs. 10*).—Such cases of poor drainage as were found to occur in the Wheatland area were shown to be due rather to waste water dumped into local depressions and flat areas, and to canal and reservoir leakage, than to any general rise of subsoil water or to alkali puddling. In consideration of the duration of the irrigation period it is believed that the area in question is "unusually free of soluble alkali salts." Small proportions of white alkali were found in the poorly drained soils, where they appeared to have been concentrated from the irrigation water. The subsoils and the rocks in the vicinity were found to be free from harmful soluble salts. "The nature of the soil and topography are favorable to complete removal of soluble salts by drainage."

Pot tests in the greenhouse and field tests indicated large increases in yields from small applications of superphosphate (acid phosphate). Chemical examination suggested that such results may have been due in some instances to a low original content of available phosphate, while in other cases the reduction of phosphates by poor cropping methods appeared to have been the cause of the phosphate poverty.

The surface water table was observed to reach its greatest height about four months after the beginning of irrigation, while the permanent water table, found at from 20 to 40 ft. below the surface, "has shown a gradual rise during the 35 to 40 years of irrigation on this project."

A description by B. Truog of the modified Denigés method for available phosphorus in soils (*E. S. R., 47, p. 714*) is appended.

The so-called "build-up" and "break-down" of soil zeolites as influenced by reaction, P. S. BURGESS (*Arizona Sta. Tech. Bul. 28 (1929), pp. 101-135, figs. 7*).—Both natural soil zeolites and soil compounds artificially prepared were studied with relation to their base-exchange capacity, inactivation, reactivation, and other changes brought about under experimental conditions.

It was shown to be possible to restore to soils or to artificial zeolites the base-exchange capacity destroyed by acid treatment by percolating the activated material with alkaline solutions. A partial breakdown of the zeolitic complex was brought about by the leaching of the soil with relatively large volumes of dilute solutions of organic acids or of "carbonic acid." The extent of this breakdown was found to amount to 1.2 per cent in the case of the treatment with a saturated solution of carbon dioxide and reached 18.4 per cent with 0.1 M citric acid, appreciable quantities of hydrogen zeolite appearing in all cases. A calcium zeolite soil of which the zeolite complex had partially been broken down with a dilute organic acid was built up by treatment with an alkaline salt solution to an exchange capacity greater than the original.

"From a study of the conditions necessary for these processes, it seems probable that active 'build-up' of soil zeolites takes place largely in the calcareous soils of arid and semiarid regions where alkaline soil solutions prevail, and that the disintegration or 'break-down' process is more common in the more or less acid soils of humid regions. From the work reported in this bulletin, it appears possible to alter quantitatively the zeolitic fraction of soils. It also suggests that the base-exchange complex may not be as fixed and immutable as many soils investigators have heretofore assumed."

Bacteriological effects of green manure, III, C. F. BRISCOE and H. H. HARNED (*Mississippi Sta. Tech. Bul. 17 (1929), pp. 11, figs. 2*).—This is a continuation of work previously outlined (*E. S. R., 42, p. 622*).

In a 7-year test as to the amount of green manure that may be turned under and give an increase in yield of the following crop, the limit appeared to be around 40 tons per acre. It is concluded that "as large a crop as can be grown may be turned without fear of injuring the succeeding crop if the proper moisture and liming conditions are available."

The weight of crops produced was found rather closely related to the bacterial count and the total nitrogen determined. The cylinders producing comparatively low crops showed the same variety of bacterial species as did the cylinders producing larger crops, from which it is concluded that "there was, therefore, an abundance of kinds and numbers of ammonifying organisms to change to ammonia all the protein food material present in any soil."

It was found that legumes may need artificial inoculation when grown after one or more dry seasons or on fields not recently in legumes, and in some other less definite cases of the absence of the specific organism of the legumes planted. "The use of legumes in crop rotations furnishes a rapid method to build up soil fertility, as was shown by an increase of 52 per cent of total nitrogen in eight years' time."

Fertilizer rotation experiments at the Pee Dee Station, T. S. BUE, R. E. CURRIN, E. D. KYZER, and J. D. WARNER (*South Carolina Sta. Bul. 262 (1929)*, pp. 38, figs. 2).—Rotation fertilizer tests in continuation of previous work (E. S. R., 47, p. 23) are reported, the results being considered under the general heads of climatological data, fertilizer experiments, and rotation experiments.

"Increasing the percentage of phosphoric acid to as much as 12 per cent in a 1,000-lb. application of complete fertilizer has given marked increases in the yield of cotton in the rotation series.

"Applications of phosphorus have materially increased the earliness of the cotton crop as indicated by the percentage of total yield secured at the first picking. As much as 4, and possibly as much as 8 per cent phosphoric acid in the 1,000-lb. application has given profitable increases in the yield of corn and oats. For cotton, the three phosphatic fertilizers tested ranked as follows: Superphosphate, basic slag, and ground rock phosphate. In the production of the other crops in the rotation, basic slag gave slightly higher yields than either of the other materials.

"Additional increments of nitrogen as high as 5 per cent of ammonia gave increases in the yield of cotton grown in a rotation, and as high as 10 per cent ammonia was efficient where cotton was grown continuously.

"Large amounts of nitrogen had the effect of delaying the maturity of the cotton crop when grown in a rotation. Increasing the nitrogen to as much as 6 per cent of ammonia in the complete fertilizer had the effect of increasing the yield of corn, oats, and hay. Side dressing cotton with nitrate of soda on June 15 was preferable to July 15 or on both dates. Additional applications of readily available nitrogen did not—under the conditions of these tests—increase the yield of corn, oats, and hay.

"Increasing the percentage of potash in a 1,000-lb. application to 5 per cent for cotton in a rotation and to 4 per cent for cotton grown continuously was profitable. Potash had the apparent effect of slightly delaying the maturity of the cotton crop, but this is explained as being due to the greater late season yield where potash was used. Increasing the amount of potash in the complete fertilizer had practically no effect upon the yield of corn and oats, but slightly increased the yield of hay. The two forms of potash tested, kainit and muriate, proved of almost equal efficiency except for oats. Kainit produced an increase of 5.2 bu. oats per acre over muriate.

"Lime, under the conditions of this test, consistently depressed the yield of cotton, corn, oats, and hay. Ground limestone gave slightly better results than did an equivalent amount of caustic lime.

"Despite the fact that in 1914 higher cotton yields were secured on the continuous than on the rotation plats, by the end of the third year the benefits of the rotation were apparent, for there was a difference in yield of approximately 100 lb. of seed cotton per acre in favor of the unfertilized plats in the rotation for this period. The fallacy of attempting to produce cotton continuously without fertilizer regardless of the cropping system was clearly shown by the end of the second rotation, for at this time the yield of cotton showed marked decline.

"Even light applications of nitrogen served to postpone the time when continuous culture of cotton was unprofitable. As the amount of nitrogen in the fertilizer was increased, this time was still further postponed. Even with 10 per cent of ammonia in a 1,000-lb. annual application, the yields on the continuous plats were lower than on the rotation. Over a period of 15 years 4 per cent ammonia in the continuous series produced almost exactly the same total yield as was produced on the rotation plats with only phosphorus, potash, and no nitrogen.

"Sixteen per cent of phosphoric acid in the analysis has given slightly higher yields of cotton in both the rotation and continuous series than has four per cent.

"The advantage of a rotation was clearly shown by the average yield produced in wet seasons. At such times the relative yield of the continuous plats was much lower than during dry years. Fertilizer and rotation have maintained the yield of cotton as well as, or better than, has been done by the State at large."

Fertilizer tests, M. S. GRUNDER (*Western Washington Sta. Bul. 14-W* (1929), p. 8).—On a muck soil with a rotation of corn, oats, kale, and potatoes the largest quantities of phosphorous and potassic fertilizers gave the largest corn and kale yields over a 5-year period, whereas potatoes yielded most in the high potash plats. In 1929 the oats yielded most with a treatment of 15 tons of manure to the acre.

The comparative values of different phosphates, C. A. MOOREs (*Tennessee Sta. Bul. 141* (1929), pp. 18, fig. 1).—Superphosphate, basic phosphates, and finely ground rock phosphate were compared in 10-year tests near Crossville, in Cumberland County, here detailed. In general the superphosphate gave the largest profits. The results varied among various crops grown, however, and between limed and unlimed lands. The basic phosphates were in some instances superior to superphosphate on unlimed land, on which also the differences in profit among all the forms of phosphate used, excluding rock phosphate, were relatively very small.

For land not recently limed the basing of superphosphate or the use of a mixture of superphosphate and ground limestone is considered desirable, local conditions being such usually that "the proportion of the ground limestone might well be increased to three times that of the acid phosphate."

Commercial fertilizers, H. R. KRAYBILL ET AL. (*Indiana Sta. Circ. 163* (1929), pp. 73, fig. 1).—The usual analyses and information for the purchaser are given. Sales of low grade and medium grade mixtures amounted in 1928 to less than 7,000 tons, as against more than 179,000 tons of high grade fertilizers.

Analyses of commercial fertilizers, H. E. CURTIS, H. R. ALLEN, and L. GABLE (*Kentucky Sta. Bul. 290* (1928), pp. 435-531).—The usual report of analyses and guaranties is made for the year 1928.

Commercial fertilizers, 1929, J. M. BARTLETT (*Maine Sta. Off. Insp. 133* (1929), pp. 49-72).—On the basis of the analyses of mixed fertilizers and of

individual fertilizer components here reported the products offered for sale in Maine in 1929 were found, "on the whole, quite satisfactory as regards plant food found and guaranteed."

AGRICULTURAL BOTANY

Vegetative propagation from the standpoint of plant anatomy, J. H. PRIESTLEY and C. F. SWINGLE (*U. S. Dept. Agr., Tech. Bul. 151* (1929), pp. 99, pls. 24, fig. 1).—A joint contribution from the University of Leeds, England, and the U. S. Department of Agriculture.

Pointing out that from the standpoint of causal anatomy the problems of vegetative propagation lie in the initiation and development of an adventive shoot or root, or both, upon an isolated portion of a living plant, the authors discuss in detail the anatomy of the initiation of new stem and root growing points in sea kale.

The formation of shoots upon stems, hypocotyls, leaves, and roots, and of roots upon roots and upon shoots, and also of adventive embryos is considered. Particular attention is devoted to the rooting processes in hardwood cuttings, notably the apple. The occurrence of root-borne buds is shown to be closely correlated with the anatomical features at the point of emergence; for example, a rupture of the endodermis which allows the passage of solutes. Here adventive stem growing points may form, usually through the intermediary of callus tissue.

Discarding various theories of polarity, the authors conclude that adventive structures are not determined by the movement of formative substances but believe that "the behavior of the living meristematic cell is determined by its position." Whether to be a root or shoot is believed determined by the fact that roots usually arise endogenously in close association with the relatively alkaline phloem side of the cambium, or pericycle in young organs, while shoots generally arise exogenously in the relatively acid cortex cambium. The subsequent development of adventive apical meristems requires an internal and external environment essentially like that required by the corresponding growths upon the parent plant. These conditions are discussed.

The utilization of abnormalities in plant culture [trans. title], H. MOLISCH (*Gartenbauwissenschaft. 1* (1928), No. 1, pp. 3-9, figs. 4).—A brief account is given regarding utilized or utilizable abnormalities in plants, including such features as growth, coloration, and seedlessness.

Can nodule bacteria of leguminous plants fix atmospheric nitrogen in the absence of the host? F. E. ALLISON (*Jour. Agr. Research [U. S.]*, 39 (1929), No. 12, pp. 893-924).—Laboratory experiments conducted over a period of five years with a total of 31 strains of legume nodule bacteria grown in a large number of media under a wide variety of cultural conditions showed in no instance any evidence that Rhizobia can fix atmospheric nitrogen when grown apart from the host. In many cases there were noted slight losses of nitrogen, but the departures from the controls were not considered significant.

Qualitative tests for nitrates in the cultures after the end of the growth period failed to show any nitrates. In concluding, the author states that there is little justification for the current assumption that legume nodule bacteria can fix nitrogen when grown independently of the host. The importance of the host plant in the utilization of free nitrogen gas is commented upon, with the suggestion that the higher and lower plants may work in close co-operation in the fixation process.

Iodine in plants [trans. title], O. ENGELS (*Gartenbauwissenschaft, 1* (1928),

iodine for plant organisms and the influence of this element on returns in agriculture and horticulture states that in the majority of cases no crop increase due to iodine could be ascertained. A stimulating influence of iodine appears very doubtful. It is not thought possible by making particular additions of iodine to soil to increase in general the iodine content of the crops. It is known, however, that several common vegetables contain iodine, and the cultivation of these is recommended.

Effect of various fumigants on the germination of seeds, H. D. YOUNG (*Jour. Agr. Research* [U. S.], 39 (1929), No. 12, pp. 925-927).—Of six fumigants, namely, ethylene oxide, tertiary butyl chloride, isopropyl formate, methyl chloroacetate, ethylene dichloride, and trichloroethylene, tested in respect to their effect on the germination of wheat, oats, barley, rye, corn, buckwheat, sunflower, beans, Lima beans, cowpeas, alfalfa, clover, and timothy, ethylene oxide and methyl chloroacetate were found injurious. With the larger concentrations of ethylene oxide employed, namely, twice that found necessary to kill in 24 hours rice weevils buried in wheat, 9 species showed no germination whatsoever, and, with the exception of alfalfa, the others were seriously injured. Alfalfa was by far the most resistant of the species. Cowpea germination, low in the controls, was stimulated markedly by the weaker concentrations of the four noninjurious chemicals.

GENETICS

The trend of morphology, C. R. STOCKARD (*Science*, 69 (1929), No. 1788, pp. 363-372).—The author points out certain intimate relationships between morphology and other physical, chemical, and biological sciences.

Cytological studies in the Betulaceae.—II, *Corylus* and *Alnus*, R. H. WOODWORTH (*Bot. Gaz.*, 88 (1929), No. 4, pp. 383-399, figs. 50).—A further report (*E. S. R.*, 61, p. 215) in which the author found in an examination of 10 species, 4 varieties, and 3 known hybrids of *Corylus* no evidence of polyploidy. Throughout the genus there occurred a uniform number (14) of haploid chromosomes, although fusion of one or more pairs often led to difficulties in counting. Natural hybrids are considered rather common, the plants showing some of the cytological peculiarities associated with heterozygosis.

In *Alnus* the basic number of chromosomes was also 14, but with diploid and tetraploid forms occurring. Hybrid forms were also observed in *Alnus*, one species, *A. rugosa*, showing marked hybrid cytological characters. *A. rugosa* and *A. glutinosa* exhibited fusion of bivalent chromosomes. Cytomyxis and chromosome migration were observed to take place in certain species of *Corylus* and *Alnus*.

Chromosome number and the mutation rate in *Avena* and *Triticum*, L. J. STADLER (*Natl. Acad. Sci. Proc.*, 15 (1929), No. 12, pp. 876-881).—The mutation rate under X-ray treatment was determined at the University of Missouri, in cooperation with the U. S. Department of Agriculture, in species of different chromosome numbers in both *Avena* and *Triticum*. Dormant seeds were treated in all cases and for periods of 5, 10, 20, 30, or 40 minutes. The longer periods were often injurious.

A. byzantina and *A. sativa* (21 chromosome pairs) yielded no mutations, *A. brevis* and *A. strigosa* (7 pairs) 14, *T. monococcum* (7 pairs) 4, *T. dicoccum* (14 pairs) 1, *T. durum* (14 pairs) 6, and *T. vulgare* (21 pairs) 0.

"The results as a whole support the hypothesis that the frequency of induced mutation observed in polyploid species is low because of gene reduplication. This does not imply that other factors may not affect mutation rate as well. It is possible that the basic mutation rate may differ materially in different groups.

The data available in *Avena* and *Triticum* are not yet sufficiently extensive to permit strict comparison between individual species. But it is clear in both genera that the mutation frequency (as measured by visible effects) decreases sharply with increasing chromosome number. Apparently the proportion of mutable genes not reduplicated is very small in the species with the triple chromosome number. In the species with the double chromosome number a considerable proportion of the mutable genes appear to be dominant in only one of the two chromosome groups."

Heterotypic prophases in the absence of chromosome pairing, M. C. MELBURN (*Canad. Jour. Research*, 1 (1929), No. 6, pp. 512-527, pls. 4, figs. 14).—The prophases of the heterotypic division in a wheat-rye hybrid, in which the chromosomes usually fail to mate, are described from studies at the University of Saskatchewan and compared with those in the pure parents (*Triticum vulgare*, Prolific rye) in which mating is normal.

Up to the end of synizesis the events in the hybrid are in all essentials exactly the same as in the pure parents. Consequently the appearances in these stages can have no significance in relation to mating, because mating does not occur in the hybrid. The first striking differences in behavior occur in the stages between synizesis and second contraction when the spireme of the pure species forms loops, the sides of which approximate and twist about each other. In the hybrid spireme the loops are quite irregular. At diakinesis in the pure species three bivalents can be found connected, the mode of attachment being one which could result only from a telosynaptic arrangement of chromosomes. The entire evidence obtained is in accord with the theory that the spireme is composed of univalent chromosomes "in tandem," and that mating by the formation of loops begins in the postsynizetic period when chromosomes are relatively long and thin. This appears to afford ample opportunity for crossover phenomena.

Some aspects of polyploidy in relation to the cereal crops, C. L. HUSKINS (*Sci. Agr.*, 10 (1930), No. 5, pp. 313-320).—Features of the cereals apparently associated with their polyploid nature are discussed in some detail. Considering that wheat, oats, barley, and rye all have the basic chromosome number seven, polyploidy, the replication of the basic number, evidently has played an important part in the evolution of wheat and oats. The kind of polyploidy involved is, in the author's opinion, allopolyploidy, i. e., chromosome doubling after hybridization. Allopolyploidy serves to perpetuate the results of hybridization in relatively true-breeding forms. The common occurrence of polymeric or duplicate factors and the relatively frequent occurrence of chromosome aberrations in wheat and oats are attributable to polyploidy. These aberrations may simulate gene mutation. The strict applicability of the pure line theory to polyploids is doubted.

The cell division at which crossing-over takes place, J. W. GOWEN (*Natl. Acad. Sci. Proc.*, 15 (1929), No. 3, pp. 266-268).—From data obtained on 16 cross-overs occurring in 10,000 matings of *Drosophila* in which but a single cross-over occurred in the progenies of single females, it is concluded that crossing over occurs in the chromosomes as they prepare for the first maturation division. No complementary crossover classes were found in the progenies of single females, and crossing over is known to take place in the four-strand stage, which therefore limits it to the first maturation division.

Embryonic segregation and its rôle in the life history, F. R. LILLIE (*Ztschr. Wiss. Biol., Abt. D, Arch. Entwickl. Mech. Organ.*, 118 (1929), pp. 499-533, figs. 3).—The author discusses the processes of embryonic development, dealing with the origin of the diverse specific potencies, referred to as embryonic segregation, that appear in the organism in the course of its life history.

Embryonic segregation in any given species has a certain definite time order in the life history of that species. It possesses a dichotomous characteristic, exemplified in cell lineage, but is no less real in the development of vertebrates. The time incidence of embryonic segregation with reference to morphogenesis is the same in any given species, but variable when different species are compared, demonstrating that it is an independent variable of the life history. Embryonic segregation is not a process of organic formation. Its mechanism is presumed to be the same throughout the animal kingdom, and it is suggested that the mechanism must have a protein basis, for which immunological evidence is offered.

Morphogenesis is not a result of embryonic segregation but rather a process in which the results of embryonic segregation are utilized.

Selective segregation of chromosomes in males of a third species of *Sciara*, C. W. METZ (*Natl. Acad. Sci. Proc.*, 15 (1929), No. 4, pp. 339-343).—In continuing the series on selective segregation of chromosomes in *Sciara* species (E. S. R., 60, p. 30), studies of the inheritance of a mutation characterized by fusion of two-wing veins in *S. impatiens* indicated that males transmitted only the maternal member of the chromosome pair in which the gene "fused" was located.

Genetic identification of the sex chromosomes in *Sciara* (Diptera), C. W. METZ and S. S. ULLIAN (*Natl. Acad. Sci. Proc.*, 15 (1929), No. 2, pp. 82-85).—Studies of the inheritance of a character, swollen wing veins, a clear-cut recessive, which exhibits typical sex-linked inheritance, are taken to indicate that sex chromosomes are responsible for sex determination in this species. Females are XX and males XY. In addition males have a pair of large sex-limited chromosomes not observed in females.

Evidence that "unisexual" progenies in *Sciara* are due to selective elimination of gametes (sperms), C. W. METZ (*Amer. Nat.*, 63 (1929), No. 686, pp. 214-228).—The results of sex studies in *S. coprophila* are presented which indicate that the production of unisexual progenies by females is not due to a differential mortality of the zygotes. It is therefore assumed that a selective elimination or inactivity of sperms occurs, so that in female-producing females the X sperms only function in the fertilization of the ova while in the male-producing females the Y sperms are the only ones to function.

The limit of radiation frequency effective in producing mutations, E. ALTENBURG (*Amer. Nat.*, 62 (1928), No. 683, pp. 540-545).—Irradiation of male *Drosophila melanogaster* with doses of ultra-violet light varying up to the limit of viability of the males had no appreciable effect on the production of lethal mutations in the X chromosome.

A spontaneous mutation in the house mouse, G. PINCUS (*Natl. Acad. Sci. Proc.*, 15 (1929), No. 2, pp. 85-88).—The author reports the occurrence of a dominant mutation for white belly which was located as a fifth allelomorph in the agouti series. The possibility of the white-belly factor being closely linked to the agouti gene but not an allelomorph was also suggested.

A "half and half" skin-color mosaic in the chicken, W. V. LAMBERT (*Jour. Heredity*, 20 (1929), No. 4, pp. 167-169, fig. 1).—A mosaic bird was found at a poultry packing plant after picking which had white skin on one-half of the body and yellow skin on the other half. The division in skin color was along the median line. The case is explained by assuming that the bird was a White Leghorn of the composition *Ww* with nondisjunction of the chromosome carrying white occurring in one of the early mitotic divisions or by dominant mutation if the bird were homozygous recessive yellow.

Two further notes on the origin of dominance, R. A. FISHER (*Amer. Nat.*, 62 (1928), No. 683, pp. 571-574).—The author cites evidence from cotton and

poultry to support the conception advanced in a previous paper (E. S. R., 62, p. 28) regarding the acquirement of dominance in response to a mutation. In the early domestication of poultry, matings with wild fowls were probably common and there was therefore selection for the dominant mutations.

Fisher's theory of dominance, S. WRIGHT (*Amer. Nat.*, 63 (1929), No. 686, pp. 274-279).—In considering the relation of dominance to evolution, the author points out that selection in case of mutations at the rate of one per million, as suggested by Fisher, would be extremely slow. Certain other features of Fisher's papers (see above) are also discussed.

A few-seeded bud sport of the tomato, J. W. LESLEY (*Jour. Heredity*, 20 (1929), No. 11, pp. 531-533, figs. 3).—Bud variant branches capable of asexual but not seminal propagation were discovered on plants of the Stone and Globe tomatoes. The sporting branch of the Globe bore small fruits with very few seeds, but had the same number of somatic chromosomes (24) as was found in the tissue of normal plants. Since normal plants resulted from the selfing of flowers on variant branches, the author concludes that these bud variants originated as mutations of the epidermis and had no genetic foundation.

Abnormal seed development in sweet clover species crosses: A new technique for emasculating sweet clover flowers, L. E. KIRK (*Sci. Agr.*, 10 (1930), No. 5, pp. 321-327, figs. 4).—When white-flowered sweetclover is crossed with yellow-flowered sweetclover, or vice versa, small shrunken nonviable seeds are produced. Of 940 flowers emasculated and cross-pollinated at the University of Saskatchewan, 647 set seed, of which 61.6 per cent were abnormal. About the same proportion of emasculated flowers produced normal seed when pollinated with pollen from the same plant. Abnormal seed development was assumed to account for the rarity of natural hybrids (E. S. R., 60, p. 429) between these species of sweetclover. About 7 per cent of the emasculated and cross-pollinated flowers produced normal seeds, which were believed to be the result of self-fertilization.

A new technic for emasculating the flowers of sweetclover by suction, described in detail, was about 87 per cent efficient in these experiments.

A genetic conception of hardiness, M. J. DORSEY (*Sci. Agr.*, 10 (1929), No. 3, pp. 193-199).—A general discussion of the hardiness problem as related to fruits, with particular consideration upon the inheritance of hardiness.

The work of the genetics department of the Cotton Research Station, Trinidad, S. C. HARLAND (*Empire Cotton Growing Rev.*, 6 (1929), No. 4, pp. 304-314).—Recent activities described briefly were concerned with inheritance of color of flower and plant, leaf shape, seed fuzz, chlorophyll deficiency, and interspecific hybrids. The weak points of some commercial types of cotton are indicated.

Tenuous kafir plants, J. B. SIEGLINGER (*Jour. Heredity*, 20 (1929), No. 12, pp. 565, 566, figs. 2).—Very slender, grasslike plants observed in a single head row of F₂ plants from Sunrise kafir × Red kafir at Woodward, Okla., in 1926 produced practically no secondary or coronal roots but made all of their development from single seminal roots. Most of the tenuous plants did not head, and the heads appearing bore only rudimentary glumes and ovaries and no anthers or stigmas. Cultures of the parent and progeny material gave evidence that a single recessive factor exists which in homozygous condition prevents the development of coronal roots and the thickening of stems and leaves. This reduces the development of the plants to such an extent that they do not fruit.

Inheritance of colour in asters.—A preliminary report, W. M. FLEMING (*Sci. Agr.*, 10 (1929), No. 4, pp. 272-275).—Seeking information concerning color dominance in the aster as an aid in the maintenance of pure stocks, a large

number of strains were grown together at the Dominion Experimental Station, Summerland, B. C. Natural crossing approximating 10 per cent was recorded and is deemed an explanation of the appearance of odd colors. Purple was found dominant to pink and white; in fact, a color range is suggested with purple at the top, red in the middle, and white at the bottom. Deep pink was dominant to white, but the relation of flesh pink and shell pink to white was not clearly established.

The inherited coat-colour of horses, with reference to the genetic constitutions of varieties of bay, K. MASUI and S. ADACHI (In *Proceedings of 3. Pan-Pacific Science Congress, Tokyo, 1926*. [Tokyo: Natl. Research Council of Japan], 1928, vol. 1, pp. 1150-1157).—From horse breeding records the authors found that some chestnut horses evidently carried the factor for bay in the absence of the factor for black without visible effect.

Color changes in *Lepus americanus* and other animals, S. HADWEN (*Canad. Jour. Research*, 1 (1929), No. 2, pp. 189-200, pls. 5, fig. 1).—"Observations on the color changes of *L. americanus* are recorded and discussed. Melanin is shown to be lacking in the white winter hair but plentiful in the dark summer hair, especially in the roots, thereby protecting the animal from sunburn. In view of the observations on experimental animals it is considered that the color changes of *L. americanus* are due, not to local environmental factors, but to an inherited habit. The conclusion is reached that color changes are primarily for the summer exclusion and winter retention of heat and for protection against ultra-violet light."

Genetics of canary birds [trans. title], H. DUNCKER (*Züchter*, 1 (1929), No. 4, pp. 111-125, figs. 8).—The hereditary behavior of the known factors in canary birds is briefly summarized. Among these are listed lethals and two sex-linked factors.

The inheritance of resistance to the Danysz bacillus in the rat, M. R. IRWIN (*Genetics*, 14 (1929), No. 4, pp. 337-365, figs. 4).—A more complete account of the results of investigations previously noted (E. S. R., 60, p. 726).

Studies in human inheritance.—III, A recessive factor for polydactylism in man, L. H. SNYDER (*Jour. Heredity*, 20 (1929), No. 2, pp. 73-77, figs. 4).—In continuing this series (E. S. R., 58, p. 426), a study of the occurrence in several families of negroes of a characteristic extra little finger is described. Blood group determinations were also made on the living individuals. It appears that the polydactylous character is autosomal and recessive and is not linked with the factors determining the blood groups.

The Mendelian behavior of tumors in man [trans. title], F. MICHE (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 51 (1929), No. 1, pp. 1-125, figs. 11).—The author has analyzed a large number of records dealing with the inheritance of epithelial and connective tissue tumors in men and suggests a two-factor hypothesis for their control. Certain hypotheses are set forth for explaining the influence of other conditions on tumor development, including the influence of age as based on correlation studies.

An alternative criterion of the differentiation of birds which die antecedent to a given period from birds which survive throughout the year, J. A. HARRIS and D. C. BOUGHTRON (*Amer. Nat.*, 62 (1928), No. 683, pp. 508-531, figs. 3).—The results of a statistical study of the records of egg production of the Rhode Island Red, White Wyandotte, and White Leghorn birds entered in the egg-laying contest at Storrs, Conn., from 1911-12 to 1921-22 are reported in continuation of previous studies of these records (E. S. R., 59, p. 568).

The frequency distribution in monthly egg production of birds which survived the first laying year was compared with the frequency distribution in monthly egg production of birds which died during the first laying year, as to

the identity of the two distributions by Pearson's χ^2 test. The values of P for the values of χ^2 observed in the different breeds indicated differences in the distribution of the two groups in all but 2 of the 12 months for Rhode Island Reds and in all but 3 of the 12 months for White Wyandottes and White Leghorns. It was further observed that the seasonal curves for χ^2 values, monthly egg production, and death rate were relatively parallel. The differentiation of egg production in the two classes of birds is thus roughly greatest when the average egg production and death rates are highest. Some difficulties regarding the influence of low frequency classes or classes in which there were no individuals were suggested, but this was found to be of no practical importance after grouping the data by 3-month periods.

Investigations of the fossil remains of Bohemian horses and their relation to some recent and fossil races of horses [trans. title]. M. NITSCHKE (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 51 (1929), No. 1, pp. 146-244, figs. 10).—Measurements of various portions of the skeletons of fossil horses from different sources are compared.

Life and reproduction, M. ABON (*Vie et Reproduction*. Paris: Masson & Co., 1929, pp. XI+366, figs. 190).—This book deals with the function of the various components of the living cell, the influence of secretions of the cells on other organs and tissues, and the mechanism of reproduction and heredity.

Ovists and animalculists, R. C. PUNNETT (*Amer. Nat.*, 62 (1928), No. 683, pp. 481-507, figs. 7).—An interesting account of the seventeenth and eighteenth century views regarding the part played by the male and female parents in reproduction and the origin of the developing offspring.

The growth disharmony of accessory sexual characteristics and their biological importance [trans. title], C. CHAMPY (*Ann. Sci. Nat., Zool.*, 10. ser., 12 (1929), No. 2, pp. 193-244, figs. 32).—The author discusses variations in the growth of different portions of insects and animals with reference to various anatomical parts exhibiting sex differences in size and form.

Studies on the physiology of reproduction in birds.—XXIII, Growth of the gonads and bursa Fabricii in doves and pigeons, with data for body growth and age at maturity, O. RIDDLE (*Amer. Jour. Physiol.*, 86 (1928), No. 2, pp. 243-265, figs. 8).—In continuing this series (*Id.* S. R., 59, p. 364) data are presented showing the rate of growth in weight of the body, bursa Fabricii, and gonad in the common pigeon, ring dove, and the ring dove hybrids.

The period of rapid growth of the bursa corresponds with the rapid growth of the body and thymus, and with slow growth in the gonads. When maximum size of the thymus and bursa is attained, involution follows and the testes and ovaries show an increased rate of growth. It was observed that at hatching the ovary was about twice as large as the testis, but the adult testis is from three to five times the size of the adult ovary. This is related to the presence of the follicular hormone in the egg.

The hormones of the sexual glands (*Nature* [London], 123 (1929), Nos. 3111, pp. 913-915; 3112, pp. 948-950).—Brief reviews of recent work dealing with the function of the internal secretions of the ovary and testis are given as an indication of our present knowledge of this subject.

Spermatozoön life in the female reproductive tract of the guinea pig and rat, D. E. YOEHEM (*Biol. Bul. Mar. Biol. Lab., Woods Hole*, 56 (1929), No. 4, pp. 274-297).—The author studied the duration of life of spermatozoa in different portions of the female tract of 13 guinea pigs and 14 rats after normal matings. Similar studies were made of the spermatozoa artificially injected into 11 guinea pigs and 6 rats at oestrus and 23 guinea pigs at the interoestrous period.

It was found that motile sperm were in the uterine horns and oviducts of the guinea pigs 41 hours after normal mating, and in the rats 17 hours after mating. In the cases of insemination during oestrus, motility was maintained for 41.5 hours in the guinea pigs and 12.5 hours in the rats. The duration of life of sperm artificially injected at the interoestrous period was 36 hours in the guinea pigs. There was thus no physiological difference in the uterus at oestrus and interoestrus which could be detected in the life of the spermatozoa. However, injections of sperm of rats into guinea pigs survived but 4.5 hours and guinea pig sperm injected into female rats but 11 hours. It thus appears that a nonspecies uterus has a marked effect upon the destruction of the spermatozoa.

The effect of X-radiation on the spermatogenesis of the guinea-pig, J. B. GATENBY and S. WIGODER (*Roy. Soc. [London], Proc., Ser. B, 104 (1929), No. B 781, pp. 351-370, pls. 4*).—The results of studies of the effects on spermatogenesis of X-raying the testicles of guinea pigs mildly, sufficient to produce extensive degeneration, and sufficient to produce extensive destruction of the germinal tissues followed by choking of most of the spermatid tubules by growth of the Sertoli cells, are reported. These studies indicate that the specific effect of the X-radiation on cell mitosis was to break down temporarily certain lipoid substances, located at the cortex of the sphere (Golgi apparatus), which play an important part in mitosis. The centrosome did not appear to be radiosensitive.

The distribution of the estrus-producing and estrus-inhibiting hormones in the ovary of the cow, W. B. PAYNE, H. VAN PEENAN, and G. F. CARTLAND (*Amer. Jour. Physiol., 86 (1928), No. 2, pp. 243-247*).—Studies of the oestrus-producing and oestrus-inhibiting hormones in the ovary indicated that the cholesterol-free unsaponifiable fractions of the corpus luteum, in terms of the dried gland, contained 35 rat units of the oestrus-producing hormone and 42 guinea pig units of the inhibitory hormone per kilogram. The ovarian residue contained 66 rat units of the oestrus-producing hormone, but this hormone was lacking in the unsaponifiable fractions of the ovarian residue.

Experiments concerning ovarian regeneration in the white rat and white mouse, R. I. PENCHEZ (*Jour. Expt. Zool., 54 (1929), No. 2, pp. 319-341, figs. 7*).—In a study of the possibility of regeneration of ovarian tissue, 85 rats and 20 mice were completely ovariectomized at ages from 25 to 180 days. The ovarian activity was determined by the vaginal-smear method and checked by autopsy. In these cases it was invariably found that there was no trace of the ovary, and that the uterus and oviduct had undergone considerable regression. The adrenals were markedly reduced in size. Three cases of possible ovarian regeneration were explained as due to the breaking of the ovaries in removal or the presence of injuries in one ovary, thus, in each case, resulting in incomplete removal. In 27 individuals the ovaries were partially removed as controls.

The experiments as a whole indicated that ovarian tissue, provided removal has been complete, does not arise from nongerminal material; that initial absence of cycles is not proof of complete ovariectomy; and that fragments remaining after partial ovariectomy may undergo extensive hypertrophy and such hypertrophied fragments may become functional, resulting in the production of normal ova followed by pregnancy. Litters were born in three such cases.

A comparison of spontaneous activity of the albino rat with the ability to learn, with special reference to the effect of castration and ovariectomy on these processes, W. W. TUTTLE and S. DYKSHORN (*Physiol. Zool., 2 (1929), No. 2, pp. 157-167*).—From a study of the voluntary activity and ability to

learn in castrated and ovariectomized rats in five litters, it was found that prior to puberty there was no difference in these characteristics. There was, however, a correlation between the spontaneous activity and ability to learn.

The sexual cycle of female domesticated mammals, M. KUPFER (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research, 13-14 (1928), pt. 2, pp. 1209-1270; Sup., pls. 13*).—The author gives a brief account of the development of the Graafian follicle, maturation of the ovum, and formation of the corpus luteum in mammals. The behavior of the ovaries of cattle, sheep, goats, pigs, donkeys, horses, and mules under normal conditions is described, as well as the ovaries of cattle during disturbed sexual function, including pregnancy.

The paper is based on observations made on livestock in Central Europe and South Africa, and includes a series of plates showing diagrammatically the changes in the ovaries of the several animals during the oestrous cycle and in the immature ovaries of the donkey mare.

Effect of different amounts of sexual indulgence in the albino rat.—VI, Life span and cause of death, J. R. SLONAKER (*Amer. Jour. Physiol., 85 (1928), No. 1, pp. 106-117, fig. 1*).—In concluding this series (*E. S. R., 62, p. 127*) it was found that normal reproduction was more favorable to the longevity of both the female and male than chastity, as both sexes had shorter average life spans when sexual indulgence was not permitted than was observed in the breeding groups. Females were more affected in this respect than males. Excessive sexual indulgence without the production of young tended to shorten the life span, as did destroying the young at birth and promptly remating the females. The occurrence of tumors, digestive disturbances, organic trouble, and lung diseases in the different groups is also summarized.

On the question of twin production in rodents [trans. title], E. FISCHER (*Ztschr. Wiss. Biol., Abt. D, Arch. Entwickl. Mech. Organ., 118 (1929), pp. 352-358, figs. 4*).—A field mouse showing a complete doubling of the posterior parts, which X-rays showed started in the region of the cervical vertebrae, is described. This mouse was born alive and evidently survived for some time after birth.

Mental and physical traits of identical twins reared apart, I-III, H. H. NEWMAN (*Jour. Heredity, 20 (1929), Nos. 2, pp. 48-64, figs. 4; 3, pp. 96-104, figs. 2; 4, pp. 153-166, figs. 7*).—Three studies in this series are reported as follows:

Case I. The author describes the differences in the palm prints and the mental and physical characteristics of a pair of apparently identical twins separated for 17 years, at the age of 18 months. It appeared that the separation and difference in environment were responsible for bringing about divergence in intellectual ability, but their temperamental and emotional traits remained unusually similar, as determined in tests conducted at the age of 19 years.

Case II. The mental and physical characteristics of a pair of monozygotic twin girls are described. The twins were separated at 18 months of age and reared apart for 19 years under somewhat similar conditions, except that one received a high-school education while the other went only through the fifth grade. The former twin excelled in mental tests, but there was remarkable similarity between the two twins in emotional traits and temperament.

Case III. An account is given of the mental and physical characteristics of a set of monozygotic male twins separated in infancy and not again united until they were 22 years old. Although the environment and training of the two were quite similar except that one spent more time in cities and the other

more time in the country, the personalities of the two were utterly different. In mentality they seemed identical, but the one who received a slightly better education showed superiority in this respect. The latter was also more reserved and less friendly.

FIELD CROPS

Some outstanding results of agronomic research and the value of such contributions, M. J. FUNCHESS (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 12, pp. 1117-1129).—Significant results in the improvement, introduction, culture, and nutrition of crops and the improvement and management of soils from agronomic investigations at the several State experiment stations and the U. S. Department of Agriculture are reviewed, and the values of such contributions to farmers are estimated.

Field experiment, W. H. BECKETT (*Gold Coast Dept. Agr. Bul.* 16 (1929), pp. 266-282).—Field experimentation is discussed briefly under the topics of layouts, analysis, comparison of layouts, observation and sampling, and application to local conditions. The bibliography embraces 87 titles.

Crops and plant-breeding, F. L. ENGLEADOW (*In Agricultural Research in 1928. London: Roy. Agr. Soc. England, 1929, pp. 1-33*).—Recent research activities in Great Britain (*E. S. R.*, 60, p. 532) are reviewed under the topics of some recent investigations on sugar beet; the importance of a full and even plant in cereals and sugar-beet; the canning of British produce; take-all, deaf ears, and certain other diseased conditions in wheat; and the growing and marketing of corn [small grain] in England and Wales.

[Field crops experiments at the Western Washington Station], M. S. GRUNDER (*Western Washington Sta. Bul.* 14-W (1929), pp. 7, 8, 9, 10).—Alsike clover combinations consistently outyielded red clover combinations for hay, the best plat, bearing alsike and timothy, averaging 9,500 lbs. per acre. Alsike clover also held its stand better than red clover. Upland pasture (*E. S. R.*, 60, p. 732) receiving lime and superphosphate gave the most grazing, 189 days, and the plat receiving manure and superphosphate 156 days. Over the period 1923-1928 the respective averages of these plats were 202 and 200 days, compared with 161 days of grazing from the check. Common vetch fall drilled deep made higher average forage yields during 6 years than shallow drilled, and broadcast vetch yielded least. Seed yields from deep and shallow drilling were similar, about 10 per cent higher than broadcast plantings. October seedlings produced the most seed and forage and the December the least.

Physiological importance of calcium in legume inoculation, W. A. ALBRECHT and F. L. DAVIS (*Bot. Gaz.*, 88 (1929), No. 3, pp. 310-321, figs. 4).—The essentials of this contribution from the University of Missouri have been noted from another source (*E. S. R.*, 62, p. 226). Differences between cells of calcium-starved and calcium-fed soybean plants are described briefly.

Effect of harvesting wheat and oats at different stages of maturity, H. K. WILSON and S. M. RALEIGH (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 11, pp. 1057-1078, fig. 1).—In Minnesota Experiment Station studies continuing those of Army and Sun (*E. S. R.*, 57, p. 525), Marquis wheat severely injured by leaf rust (*Puccinia triticea*) and black stem rust (*P. graminis tritici*) and Victory oats severely infected by crown rust (*P. coronata*) and stem rust (*P. graminis avenae*) were harvested every two days between the milk stage and maturity, covering 13 and 12 days, respectively. From the milk to maturity the increases were usually progressive in grain yield, kernel development, grain quality, dry matter, and with wheat, especially in loaf color and in milling and baking

quality. Evaporation of water from plants as measured by the atmometer was greater in shocks built from more mature plants. Decreases were observed in nitrogen content, straw yields, and percentage of oats hull. No change was recorded in grade, since the low bushel weight of both cereals caused all grain to be designated as sample grade, nor in internodal length. Neither the method of drying plants nor leaving the grain either attached to full length plants or in severed spikelets caused differences in 1,000 kernel weights.

Evidently, from the above and earlier results, no advantages came from the premature harvesting of rust-infected wheat and oats.

A uniformity trial with maize, W. H. BECKETT and S. R. B. FLETCHER (*Gold Coast Dept. Agr. Bul. 16* (1929), pp. 222-226, pls. 3).—Statistical examination of the yields of corn from 15 plats chosen at random from 83 $\frac{1}{4}$ -acre plats at Asuansi Experiment Station in 1928 showed that only a general tendency existed for the weight of ears and of grain to be correlated with the number of ears, indicating that counts of number of ears are quite inadequate as yield figures for measuring the effect of a treatment in field experiment with corn. The correlation between the weight of ears and weight of grain was marked, but not close enough to render weight of ears data sufficiently reliable as an estimate of the weight of grain. There was no apparent correlation between percentage by weight of grain to ear and the mean weight of grain per ear and the number of ears. Fewer ears in a plat are not compensated by a higher weight per ear or a higher percentage of grain per ear, as might be expected. There was, however, a general tendency for the percentage of grain per ear and the mean weight of grain per ear to be correlated. Thus the actual weight of grain depended increasingly on the high percentage of grain per ear.

The effect of certain injuries to leaves of corn plants upon weights of grain produced, A. N. HUME and O. FRANZKE (*Jour. Amer. Soc. Agron., 21* (1929), No. 12, pp. 1156-1164, fig. 1).—The leaves of rows of comparable corn plants growing at the South Dakota Experiment Station were variously split, split and the midribs broken, and stripped at successive growth stages (about week intervals) between knee height and kernels dented, the periods of treatment including July 10 to September 11, 1928, and July 7 to September 8, 1927.

Removing all developed leaf blades (laminae) from corn plants at whatever period of growth always resulted in a decided depression of the quantity of grain produced. The greatest depression occurred when leaf blades were thus removed at a growth stage termed "tasseling to kernel formation." Plants having leaf blades entirely removed at this stage of growth produced 2.2 bu. per acre as compared with a normal yield of 20.5 bu. The reduction in yield was regularly less when these severe lesions occurred at periods previous to or following the stage of growth indicated, so that apparently the period of tasseling to kernel formation may be defined as a most critical time for such severe leaf injuries. Even the less severe lesions produced relatively their greatest reduction in grain yield when they occurred at this period. The average acre yield of grain from all plants with leaves split was 20.1 bu. and from plants with leaves split and midribs broken 19.5 bu.

Analogies are drawn between the experimental results and the effect of hail on the corn plant, and the physiological relations of the injuries are discussed briefly.

Relation of blade injury to the yielding ability of corn plants, G. H. DUNGAN (*Jour. Amer. Soc. Agron., 22* (1930), No. 2, pp. 164-170, figs. 3).—A detailed account is given of work summarized elsewhere (*E. S. R., 62, p. 328*).

Reports [on cotton investigations] received from experiment stations, 1927-1928 (London: *Empire Cotton Growing Corp., 1929, pp. XII+278, pls. 18, figs. 42*).—Investigations with cotton under the auspices of or by officials

connected with the Empire Cotton Growing Corporation are reported on as in previous accounts (E. S. R., 59, p. 132) from Biloela, Queensland; Barberton and Candover, South Africa; Ingwavuma, Swaziland; Gatooma, Southern Rhodesia; Shambat and other localities in Anglo-Egyptian Sudan; Uganda; Makwapala and Port Herald, Nyasaland; Daudawa, Nigeria; and Sigatoka, Fiji.

Studies in cotton pollen, I. BANERJI (*Agr. Jour. India*, 24 (1929), No. 5, pp. 332-340, pl. 1).—An investigation under the auspices of the Indian Central Cotton Committee demonstrated that cotton pollen is characteristically spherical in shape, with numerous points of emergence. The mean diameters of the cottons studied measured from spine to spine were for *Gossypium hirsutum* 149.55, *G. barbadense* 141.45, *G. indicum* 119.15, *G. neglectum roseum* 125.2, *G. cernuum* 125.95, and *G. herbaceum* 116.6 μ . Comparative differences in the size, shape, and sculpturings of the exine were noted in all the cottons studied. Two forms of pollen grains characteristically different and occurring in the same androecium were observed sometimes in *herbaceum* cottons. Artificial cotton pollen germination appeared to depend upon delicate moisture requirements. Pollen grains were found to retain their viability under natural conditions up to 24 hours after their liberation from the microsporangium and lose their potency within the next 24 hours. The more active pollen tubes were found to have traversed the entire stylar length (mean 24.7 mm., form Cambodia cotton) within 12 hours after pollination. The inheritance of pollen color in a natural cross of Sea Island cotton characterized by deep yellow pollen grains was found to depend on a single Mendelian factor (Y).

Early maturity in cotton, S. C. HARLAND (*Trop. Agr. [Trinidad]*, 6 (1929), No. 4, pp. 114-116).—An appraisal of the factors, e. g., germination period, growth rate, fruiting, shedding, maturity, and plant shape, concerned with early maturity in cotton.

The influence of "motes" on the yield and boll-size of the cotton plant, H. E. REA (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 12, pp. 1154, 1155).—Coefficients of correlation determined in 16 varieties of cotton (E. S. R., 61, p. 826) grown at the Temple, Tex., Substation in 1925 and 1926 gave indications that, although the relationship was not very close, the association between the percentage of motes and the yield of seed cotton per plant was usually negative. The percentage of motes per plant was closely and negatively associated with the average size of boll per plant, i. e., the higher the percentage of motes the smaller was the boll.

Cotton fertilizer experiments in the Salt River Valley, G. H. SEEVISS and R. S. HAWKINS (*Arizona Sta. Bul.* 129 (1929), pp. 317-337).—Fertilizer trials, largely with Pima Egyptian cotton, made at the Salt River Valley Farm and in cooperation with farmers indicated that profitable returns could not be expected at present from commercial fertilizers on heavy soils. On some of the more sandy soils the use of ammonium sulfate usually resulted in an increased yield, although not necessarily at a profit. Potassium did not pay, phosphorus alone was unprofitable, and phosphorus in combination with other nutrients returned profits in only a few cases.

Kudzu production, with special reference to influence of frequency of cutting on yields and formation of root reserves, W. H. PIERRE and F. E. BERTRAM (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 11, pp. 1079-1101, figs. 2).—Experiments with kudzu reported from the Alabama Experiment Station were concerned with the effect of number of cutting treatments on yields and on the production of reserve foods in the roots.

As the number of cuttings were fewer the greater was the production of root reserves. During a period of two years roots of plants cut six times per

season decreased in weight, those from plants cut four times increased about 150 per cent, from plants cut twice increased about 400 per cent, and roots from plants cut once increased about 1,250 per cent. Yields of top were found to depend on the amount of reserve food stored in the roots. The greatest yield of tops was obtained with the two-cutting treatment when the roots were equal in size at the beginning of the experiment. Due to the greater amount of storage material formed in the roots during the first year, however, the greatest yield secured the second year was from the one-cutting treatment. The percentage of reserve starch and nitrogen in the roots from plants cut six times was found to be less than one-half as much as in the roots of plants cut four times or less, whereas the percentage of total sugars was greater. Evidently a change from starch to sugar was taking place in the roots of plants cut six times in order to produce new top growth.

Examination of the changes during the season in the reserve food storage of the roots of plants receiving no cuttings and of the effect of late cutting on these reserves showed that the percentage of sugar did not change materially. The nitrogen percentage was high at the beginning of the season and gradually decreased while growth was rapid, but in August it again increased until the end of the season. The percentage of starch and dextrins remained very constant until sometime in September and then increased very markedly from about 30 to 45 per cent, calculated as dextrose. Cutting the tops as late as September 5 caused a marked reduction in the percentage of starch and dextrins and an increase in the percentage of sugars and water found in the roots for the remainder of the season.

The observation that the top growth from large roots was much more rapid than from small roots was taken as additional evidence that top growth depends largely on the reserve storage materials in the roots. The practical field applications of the results are pointed out.

Varieties of oats for Illinois, G. H. DUNGAN and W. L. BURLISON (*Illinois Sta. Bul.* 339 (1929), pp. 21-50, figs. 4).—Detailed report is made of varietal trials with oats during and since 1917, supplementing earlier investigations (E. S. R., 36, p. 634). The characteristics and behavior of the varieties tested are set forth briefly.

The most productive varieties grown for a minimum of five years at DeKalb included Silvermine 6-403, Iowar, Albion, Richland, and Kanota; at the station for at least four years Gopher, Albion, Kanota, Richland, and State Pride. At Alhambra among oats tested for four years the highest yielders were Victory, Silvermine, Albion, Burt, and Sixty-Day. Hull-less oats averaged very favorably with the best hulled sorts on a hull-free basis. Kanota, Sixty-Day (Illinois selection), Minota, Hull-less, Anthony, Gopher, Fowlds' Hull-less, Burt, Cornellian, and State Pride proved more resistant than other varieties to early spring freezes.

Seeding at the rate of 16 pk. per acre was best with Silvermine at DeKalb, but at Urbana the net yield with Sixty-Day increased up to a maximum rate of 18 pk. Results of seeding oats in 4- and 8-in. drill rows were not decisive, although preliminary observations indicated that for adequate stands of clover the 8-in. drill row is preferable to closer seeding and that even a wider drill row may be advisable, especially on thinner soils.

Registration of varieties and strains of oats, IV, T. R. STANTON, E. F. GAINES, and H. H. LOVE (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 12, pp. 1175-1180).—The Brunner, Rainbow, Anthony, Miami, and Wayne varieties of oats approved for registration (E. S. R., 61, p. 223), are described with records of their performances.

The value of certified Irish potato seed, J. A. McCLINTOCK (*Tennessee Sta. Circ. 25* (1929), pp. 3).—Certified potato seed showed its marked superiority by averaging during 3 years 183 bu. per acre, compared to 102 bu. from commercial, uncertified seed. Mosaic and other virus diseases were apparently responsible for the yield difference. The steady increase in the use of certified potato seed during the past 7 years indicates that growers have found certified seed profitable.

Rye in the Union of Socialistic Soviet Republics and in the adjoining countries [trans. title], V. and V. ANTROPOVY (ANTROPOV) (*Trudy Prikl. Bot., Genet. i Selekt. (Bul. Appl. Bot., Genet. and Plant-Breeding)*, 1929, Sup. 36, pp. 366, pl. 1, figs. 120; Eng. abs., pp. 312-366).—Extensive studies since 1918 on nearly 5,000 samples of species and varieties pertaining to *Secale cereale* obtained from many localities in Europe, Asia, and Asia Minor are reported on in both Russian and English. The characters of the spike, grain, and plant of rye as influenced by environment are discussed in detail, the distribution of important groups is indicated, descriptions are given of important varieties and of the Asiatic weed rye, and a determinative key to botanical varieties is appended. The milling qualities of certain ryes are described by F. N. Prokof'ev (Prokofiev) and the baking qualities by S. M. Martynov.

Varietal experiments with soybeans in New York, R. G. WIGGANS (*New York Cornell Sta. Bul. 491* (1929), pp. 19, figs. 3).—Comparative trials during the years 1922-1928, inclusive, showed that for New York conditions Black Eyebrow, Ito San, and Mansoy soybeans are best for grain, although not producing mature grain every year. Wilson, Dunfield, and Black Eyebrow are indicated for green manure and Hamilton, Wilson, and Dunfield for silage with corn. Wilson, Black Eyebrow, Dunfield, Mansoy, and Hamilton are indicated as best for hay, and together with Midwest are recommended for silage alone. Little seed of Hamilton is available at present. Agronomic and yield data and characteristics are shown for the principal varieties.

Sugar cane fuzz viability and December rainfall, R. L. DAVIS (*Planter and Sugar Manfr.*, 82 (1929), No. 18, pp. 343, 344, fig. 1).—The failure to germinate of sugarcane arrows collected in the Mayaguez district was investigated at the Porto Rico Experiment Station. See also an earlier note (*El. S. R.*, 55, p. 640).

Collections made during 3 years indicated a positive correlation between high rainfall and viability of fuzz. Less than 1 in. was unfavorable, while from 3 to 6 in. rainfall in December was found favorable to good germinations. Satisfactory germinations were secured in December, 1928, when an abnormal rainfall of 6 in. occurred. Spraying arrows gently with water during the daytime while pollination and maturation were in progress reduced the germination by half, indicating that extra high humidity is detrimental to germination and that irrigation water is sufficient for the breeding plats at Mayaguez.

[Sugarcane experiments in Queensland, 1928 and 1929], H. T. ELASTERY (*Queensland Bur. Sugar Expt. Stas. Ann. Rpts.*, 28 (1927-28), pp. 1-10, 26-71; 29 (1928-29), pp. 1-33, 46-51, figs. 4).—The current progress of investigations with sugarcane in Queensland is reviewed as heretofore (*El. S. R.*, 59, p. 136).

Physical measurements of the winter wheat plant at various stages in its development, G. JANSSEN (*Plant Physiol.*, 4 (1929), No. 4, pp. 477-491, figs. 4).—The percentages of winterkilling of winter wheat plants, determined on date-of-seeding plats during three years at the University of Wisconsin (*El. S. R.*, 61, pp. 334, 830), were found to vary with the date of seeding. Freezing and rate-of-thawing tests on plants from the date-of-seeding plats showed that sudden changes of temperature within a large temperature range affect the subsequent recovery of the plant. The temperature at which the

plant grew previous to freezing seemed important in regard to recovery after freezing. Wheat plants grown at high temperatures, 33° C., were killed when subjected to -10°, whereas those grown at 5° were not injured seriously when subjected to -10°. Rapid thawing of plants frozen at -20° resulted in their death, whereas those frozen at -5° showed no serious injury from the same rapid rate of thawing. Osmotic pressure measurements of sap from wheat plants at different stages of development did not appear to indicate the degree of winter hardiness of the plants.

Effect of delayed harvesting on yield and quality of wheat, E. H. SCHMIDT (*Md. Crop Impr. Assoc. Rpt.*, 22 (1929), pp. 245-253, fig. 1).—Wheat was cut every second day at the Maryland Experiment Station between June 26 and July 16, 1928, inclusive, and was threshed between July 10 and 16. General harvesting began at the station on July 2.

Observations in 1927 and 1928 showed that shattering does not occur to any appreciable extent in the field for at least 2 weeks after the completion of normal harvest. Examination of the several lots of threshed grain suggested that a delay for combine harvesting of a week or 10 days after binder cutting would be distinctly advantageous for yield, somewhat so for weight per bushel, and slightly detrimental for protein content. A longer delay results in no increase in yield, a loss in weight per bushel, and a further loss in protein.

Registration of improved wheat varieties, IV, J. A. CLARK, J. H. PARKER, and L. R. WALDRON (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 12, pp. 1172-1174).—New varieties of wheat approved for registration (E. S. R., 61, p. 226) and described with records of their performances included Purkof, Tenmarq, and Kawvale.

State laws concerning the sale of seeds and legume inoculants, J. G. FISKE (*New Jersey Stat. Circ.* 218 (1929), pp. 15, fig. 1).—In revision of Circular 137 (E. S. R., 47, p. 234), the texts of the act of 1916 regulating the sale of seed in the State and of the act of 1919 regulating the sale of legume inoculants are given and the requirements explained.

Weeds of New Jersey, J. G. FISKE (*New Jersey Stat. Circ.* 219 (1929), pp. 47, figs. 35).—This revision of Circular 161 (E. S. R., 51, p. 744) takes account of new developments in weed control.

HORTICULTURE

[Horticultural investigations at the Western Washington Station] (*Western Washington Sta. Bul.* 14-W (1929), pp. 16-28, figs. 4).—As in the preceding report (E. S. R., 60, p. 740), results are presented upon a comparative study by H. D. Locklin of different systems of training grapes, again showing the four-arm Kniffin to lead in production, with the Munson system a close second. Concerning the number of buds to leave after pruning, 60 gave larger yields than 40 or 20.

Of 10 fertilizers tried by Locklin on New York lettuce, a 4-8-8 (N-P-K) mixture gave the best results on both muck and sandy loam, with cow manure a close second.

A test of early-ripening tomatoes showed Viking, Fargo, and Best-of-All to be promising, as also was Golden Gem sweet corn which ripened about two weeks earlier than Golden Bantam.

Cultural studies by Locklin with various small fruits suggested that on sandy loam soils thorough cultivation is desirable for the raspberry. Winter wheat proved a satisfactory cover crop for raspberries and grapes. An application of 1,200 lbs. of 2-10-10 (N-P-K) fertilizer gave excellent results with

the Cuthbert raspberry. Spacing Ettersburg No. 121 strawberries 15, 18, 21, 30, and 36 in. in the row, the largest yield was obtained in the 15-in. spacing, with a slight decrease in the size of the berries in the closer set rows.

[Horticultural investigations at the Morden, Man., Experimental Station, 1928], W. R. LESLIE (*Canada Expt. Farms, Morden (Man.) Sta. Rpt. Supt. 1928*, pp. 16-34, 36-42, figs. 4).—In addition to results of general varietal and cultural studies with fruits, vegetables, and ornamentals, certain data are presented on apple seedlings bred at the station and on a plum propagation test in which the seeds were handled in various ways prior to planting. The best results from a 7-years' average, 36.3 per cent, were secured with washed pits not allowed to dry before sowing at a depth of 3 in.

Contributions from the Wisley Laboratory.—LIV, On the effect of length of daily period of illumination upon the growth of plants, M. A. H. TYNCKEE (*Jour. Roy. Hort. Soc.*, 54 (1929), No. 2, pp. 354-378, pls. 7, figs. 4).—A contribution from the Wisley Laboratory presenting data on light studies with various plants, including *Phacelia campanularia*, *Nigella damascena*, and *Nemophila insignis*, all of which reacted as long-day plants. Short-light periods delayed flowering in the mangel and slowed down ripening of fruit in the sugar beet. Weakening the intensity of light modified the rate of tuber production and the utilization of food products. Determinations of the rate of starch formation in attached and detached leaves of *Phaseolus multiflorus* showed more rapid formation in the leaves of plants receiving 8 and 10 hours of light than in those receiving full daylight. The author concludes that the rate at which food products are utilized for growth or storage in the tuber or seed is a factor tending to control general synthesis and the production of dry weight.

Analyses of materials sold as insecticides and fungicides during 1929, C. S. CATHCART and R. L. WILLIS (*New Jersey Stat. Bul.* 485 (1929), pp. 16).—The results are presented of the analyses of various materials offered for sale in New Jersey in 1929 (E. S. R., 60, p. 438).

The chemical composition of insecticides and fungicides, R. H. ROBINSON and C. F. WHITAKER (*Oregon Sta. Circ.* 95 (1929), pp. 19).—Interpolated with suggestions as to the use and properties of various materials, the results are herein presented of the analyses of various insecticides and fungicides examined in 1929 (E. S. R., 58, p. 838).

The relation between rate of planting and yield in garden beans, M. C. GILLIS (*Amer. Soc. Hort. Sci. Proc.*, 25 (1928), pp. 80-86).—A report on studies conducted at the New York Cornell and Illinois Experiment Stations.

Using three varieties of beans, Red Valentine, Burpee Stringless Green Pod, and Stringless Refugee, and comparing spacings of 2, 3, and 6 plants per foot in replicated plats at the New York Cornell Station, it was found that larger yields resulted from the closer spacings. Analyses of the results by Student's method showed significant odds.

Continuing the work at the Illinois Station with the same varieties, the author obtained the maximum yields with 12 plants per foot but found the gain above 9 plants per foot statistically insignificant, leading to the deduction that 9 plants per foot was the most desirable spacing. In conclusion, the author points out that soil fertility, soil moisture, and other environmental factors greatly influence bean yields and determine the best rate of planting.

Studies of the turnip rooted celery [trans. title], H. SEIDEL (*Gartenbauwissenschaft*, 2 (1929), No. 4, pp. 377-414).—Incidental to general varietal and cultural tests, chemical determinations were made at the University of Breslau upon the roots and leaves of plants receiving nitrogen and nonnitrogen fertilizers. The crude protein content of the roots and leaves increased markedly

from the no-nitrogen to the high-nitrogen series. Crude fiber of the roots was lowest in the maximum nitrogen plants, with differences less marked in the leaves. Crude fat of the roots and leaves was little influenced by increases in nitrogen, but it is considered likely that the methods of technic were not exact enough to detect changes in this substance.

The effect of number of plants per hill on yields of sweet corn for the cannery. E. S. HABER (*Amer. Soc. Hort. Sci. Proc.*, 24 (1927), pp. 37-40).—Using two varieties of sweet corn, Country Gentleman and Evergreen, planted 3.5 by 3.5 ft. in check rows but with 2, 3, 4, 5, 6, and 7 plants per hill, the author obtained the largest yield in most instances with 4 plants per hill. Above this point the yields not only fell away sharply but the size of the individual ears was also decreased. For example, in the case of Country Gentleman the percentage of ears weighing less than 8 oz. increased as follows: 18.7, 22.2, 23.3, 30, 36.5, and 42.3 for 2, 3, 4, 5, 6, and 7 plants per hill, respectively. An incidental test in which Evergreen corn was planted 3.5 by 1 ft. gave a yield of 4,342 lbs. per acre of corn, as compared with 7,542 lbs. for the lowest yielding 3.5 by 3.5 ft. lot.

Report on the scientific work. A. N. WILCOX (*Minn. Hort.*, 58 (1930), No. 1, pp. 12-15).—In connection with a general report on fruit-breeding activities at the University of Minnesota Fruit Breeding Farm, data are presented on a study of longevity and viability of pollen. Apple pollen was found to live twice as long in the dry air of a desiccator as in the open air of the laboratory, and three times as long in a vacuum as in the laboratory. As determined by B. H. Wilson, tree maturity as measured by a cessation of twig growth and by leaf abscission is not a satisfactory index to the susceptibility to subsequent winter injury. Work reported by J. H. Beaumont indicated that the parents of apple seedlings exert an important influence on survival and upon the growth.

Apple varieties that are satisfactory cross pollinizers. L. H. MACDANIELS (*N. Y. State Hort. Soc. Proc.*, 74 (1929), pp. 45-52).—Records taken at Cornell University on fruit setting of vigorous trees of Northern Spy hand pollinated with Northern Spy, Wealthy, Golden Delicious, Rome, and Delicious pollens showed sets of 5, 100, 110, 145, and 165 per cent of the normal commercial crop. On weak Northern Spy trees the set was much lower with certain of the same pollens. Delicious pollen also proved most effective for Rhode Island and McIntosh. Much larger sets of McIntosh, Rhode Island, and Northern Spy were obtained in western New York by hand pollination than by natural exposure to insects, with little difference in the case of the Baldwin, a variety which was found strongly self-fruitful.

Five years of fertilizers on a McIntosh orchard in the Hudson Valley. L. C. ANDERSON (*N. Y. State Hort. Soc. Proc.*, 74 (1929), pp. 208-212).—A comparison of four fertilizer treatments, (1) superphosphate and muriate of potash, (2) nitrate of soda, superphosphate, and muriate of potash, (3) nitrate of soda, and (4) nitrate of soda and superphosphate, in duplicated plats in a young McIntosh orchard near Upper Red Hook, N. Y., showed that nitrate of soda used alone or in combination had given substantially increased yields as compared with control plats. No treatment had any material effect on size or color of fruits, but the foliage of the nitrated trees was greener than that of the checks or of the superphosphate-muriate of potash trees. The nitrate of soda plus superphosphate trees made the greatest trunk circumference gain and the longest terminal growth, but only slightly more than from nitrate of soda alone.

Cold storage studies with the apple [trans. title], K. MEIER and H. KESZLER (*Landw. Jahrb. Schweiz*, 43 (1929), No. 6, pp. 725-784, pls. 5, figs. 18).—In this contribution from the Swiss Experimental Station at Wädenswil particular em-

phasis is placed on the storage needs of specific varieties of apples, supplementing these data with general information on the practice and science of storage. Certain varieties tested, including Boiken and Blenheim, were found to keep best between 0° and 1° C., while rough-skinned varieties, such as Boskoop and Pariser, ripened and stored better at higher temperatures, 2.5 to 4°. The need of prompt storage is pointed out, especially for early-ripening varieties. It is suggested that fruit should be withdrawn from storage before losing its quality, and the uselessness of storing overripe or diseased fruits is discussed. Storage of apples in peat reduced water loss but is not recommended except for home storage. The use of oiled wrappers and shredded oiled paper is advised.

Hybrids between *Pyrus malus* and *Pyrus fusca*, H. HARTMAN (*Jour. Heredity*, 20 (1929), No. 8, pp. 378-380, figs. 3).—Observations on a number of *P. malus* × *P. fusca* hybrids raised at the Oregon Experiment Station showed these to constitute a fairly definite type despite a considerable amount of variability. The fruit combined the characteristics of both parents, was high in acidity and astringency, and had value for pickling, jelly making, and other culinary uses.

Composition and growth initiation of dormant Bartlett pear shoots as influenced by temperature, F. E. GARDNER (*Plant Physiol.*, 4 (1929), No. 4, pp. 405-434, figs. 9).—Bartlett pear trees moved into a warm greenhouse at the University of California in October remained practically dormant during the succeeding 11 months, despite favorable moisture and temperature conditions, while comparable trees exposed to 2° C. in cold storage and to outdoor conditions developed normally. As determined by analyses of shoots taken at frequent intervals, low temperature caused an increase in hexose sugar, sucrose, and organic acids, a depression in the freezing point of the expressed sap, and a notable decrease in starch. At the same time only slight changes in these factors were recorded in the warm temperature of the greenhouse. Nonhexose reducing substances, water-soluble polysaccharides other than starch, arbutin, fats, total nitrogen, amide nitrogen, and the electrical conductivity of the expressed sap were unaffected by the temperatures employed. Although the chemical changes incidental to low temperature were not proved necessary to growth initiation, the author states that growth did not occur in their absence. A comprehensive discussion is presented upon the rest period in plants and means of breaking the same.

A preliminary report on peach fertilizer experiments in Maryland, E. C. AUGETER and A. L. SCHRAEDER (*Md. Agr. Soc., Farm Bur. Fed., Rpt.*, 13 (1928), pp. 218-227).—A summary of 5 years' records taken in a Carman peach orchard at Berlin, Md., 10 years old at the beginning of the experiment showed the largest gain in trunk circumference, terminal growth, and yield in trees receiving nitrogen alone or in combination. Potash or phosphoric acid alone or combined gave no increase; in fact, caused an apparent decrease. No significant difference was observed between nitrate of soda and ammonium sulfate, except in the first season, when the former led.

Comparable results were secured at Salisbury with Belle of Georgia trees 6 years old at the initiation of the experiment. Here again nitrate of soda was more effective than ammonium sulfate in the first season.

At Mount Airy, working with young Elberta trees planted at the beginning of the experiment, the doubling of the application of nitrate of soda to 10 lbs. per tree in the last two years had a slightly injurious effect. The use of lime with ammonium sulfate materially reduced growth and yield as compared with ammonium sulfate alone. The leaves were small, narrow, and mottled with red, and the fruit bud formation reduced. Contrary to results

at the first two locations, potash supplementing nitrogen was distinctly beneficial, especially so when all three principal elements were used together.

The fruit of nitrogen-fertilized trees matured from 3 to 7 days later than that of the nonnitrogen trees. Color inferiority on the nitrogen trees was largely overcome if the fruits were left until they reached a maturity equal to that of the nonnitrogen trees at picking time. Time of application studies at Salisbury were in favor of dormant season applications of nitrate of soda. Growth was a little better, and the yields increased about 15 per cent.

I, Irrigation experiments with peaches in California. II, Canning quality of irrigated peaches (*California Sta. Bul. 479 (1929), pp. 63, figs. 22*).—The first portion of this paper, by A. H. Hendrickson and F. J. Veihmeyer, deals with studies of the effect of different percentages of soil moisture on the peach and leads to the general conclusion that no differences in yield, growth of trees, time and relative amount of blooming, or quality of fruit are induced by soil moisture so long as the content remains above the permanent wilting percentage, which has been shown to be different with each soil. The permanent wilting percentage is considered the critical soil moisture content, trees having or not having available moisture.

Winter irrigation of Muir peach trees at Delhi produced no growth or yield increases, nor did such treatment postpone the date when the first spring irrigation was necessary. Maintenance of the moisture content continuously above the permanent wilting percentage resulted in the largest trees, but deficiencies for comparatively brief periods did not cause material decreases in yield. Deficiencies of readily available moisture over long periods did, however, markedly reduce production. The rate of growth of the fruits was not affected until the soil moisture was reduced to about the permanent wilting percentage. A deficiency of moisture during the pit-hardening period reduced the subsequent size of the fruit. Irrigation just before picking did not increase the water content of the fruit.

Peaches harvested from plats deficient in readily available moisture showed on a fresh-weight basis a slightly higher percentage of sugar and a lower percentage of water than fruits from continuously moist plats. However, when calculated to a dry-weight basis the results with sugar were reversed. Extreme differences in soil moisture did not affect the drying ratio of commercially handled Muir peaches, nor were any differences detected in keeping quality during the interval between picking and canning. In practical conclusion the authors point out that the condition of the tree is a practical index to water needs. Wilting of the leaves in the afternoon is a sign of close approach to permanent wilting, and wilting of the leaves in the morning a very definite indication of this condition.

Part 2, by P. F. Nichols, presents the results of canning tests of peaches taken from the dry and wet plats dealt with in part 1 and reports that no consistent differences were found that could be attributed to the several irrigation practices. All fruit was of satisfactory canning quality, even that taken from the high-moisture plats.

The raspberry and its cultivation in Canada, M. B. DAVIS (*Canada Dept. Agr. Bul. 114, n. ser. (1929), pp. 28, pls. 3, figs. 10*).—This is a general discussion concerning varieties, culture, and methods of handling the crop, supplemented with separate sections on the control of insects by W. P. G. Garlick and on the control of diseases by G. H. Berkeley. Yield records presented on 10 varieties grown at Ottawa show the Hiram to have been the most productive over a 3-year period.

The strawberry in Ohio, J. S. SHOEMAKER (*Ohio Sta. Bul. 444 (1929), pp. 50, figs. 17*).—In connection with a general discussion of varieties, pollination,

fruit bud formation, propagation, location of beds, choice of soils, rotations, planting methods, cultivation, mulching, etc., certain experimental results are presented.

In northern Ohio fruit bud differentiation was visible microscopically in late August or early September. In observations on Premier runners rooted in June, July, August, September to October 15, and October 16 to November, 1928, the average yields per plant in 1929 were 0.14, 0.06, 0.04, 0.01, and 0.009 qt., respectively. Applications of ammonium sulfate at different dates to Premier plants receiving a basic treatment of poultry manure, superphosphate, and muriate of potash showed August applications to be of the greatest value, a result due in the author's opinion to coincidence with the time of maximum runner formation and with fruit bud differentiation. Nitrogen tended to increase size rather than the number of plants. Early spring applications of fertilizer tended to increase yields in the later part of the picking season. Yields of Gibson plants in their first fruiting year when mulched with wheat straw, unmulched, and mulched with weedy wheat straw were in the ratio of 119, 99.3, and 88.5, respectively.

Concerning the time of runner formation, data taken on Premier plants in 1928 showed 1, 17.6, 27.6, 6.8, and 46.6 per cent forming, respectively, in June, July, August, September to October 15, and after October 15. Only a small percentage of the last lot rooted. A number of varieties are divided into two groups according to pedicel pubescence.

Summer pruning vs. non-summer pruning of grapes, R. WELLINGTON (*N. Y. State Hort. Soc. Proc.*, 74 (1929), pp. 204-207).—In an experiment at the New York State Experiment Station with 24 varieties of grapes, half of the terminal growth of the fruiting canes was removed June 29, with the new shoots that subsequently developed from the terminal buds of the pruned canes broken off at two later dates. The fruit was harvested October 8 and the percentage of sugar determined in the expressed juice. In every variety except Delaware the sugar was appreciably higher in the juice of the fruit of the unpruned plants, the difference reaching a maximum of 7.6 per cent in Melton. Notes on the relative maturity of the fruit from the pruned and nonpruned plants showed that summer pruning had delayed maturity in many varieties, particularly the late ripening kinds, and since no benefit in appearance or size of fruit resulted from summer pruning, the author concludes that the practice is both unprofitable and actually harmful.

The handling of California table grapes, C. W. MANN (*U. S. Dept. Agr. Cir.* 83 (1929), pp. 14, figs. 5).—A general discussion on production, varieties, methods of handling and packing, wilting injury, rain damage, and maturity processes.

Comparing storage behavior at 32° F. of lots of Emperor grapes, some harvested before and others after heavy rains, it was found that the percentage of decayed and shattered berries developing after storage was much higher in the rain-exposed lots, 61 per cent as compared with 16 per cent in one instance. Comparisons were also made between the keeping qualities of grapes picked and handled with care and those handled in the usual commercial way, with a material difference in favor of careful handling. A delay of from 24 to 48 hours in refrigeration was much more serious in the case of the commercially handled lot.

Trinidad and Java cacao, C. J. J. VAN HALL (*Trop. Agr. [Trinidad]*, 7 (1930), No. 1, pp. 9-12, figs. 2).—Records taken on open-pollinated seedlings and the budded progeny of mother trees selected within the Djati Roenggo variety of cacao, a probable hybrid between the Criollo and Forastero types, showed positive correlation between the yield of the mother trees and of the

progeny, both vegetative and seminal. Variability in yields was less in the vegetative clons and in the seedlings than in the mother trees. It was found that the number of pods because of variation in size was not always a reliable index to productivity. The number of fruits required to produce 1 kg. of cured cacao ranged from 20 to 59. The highest yielding strain in 1927 averaged 77.4 pods per tree as compared with 100.7 for the next strain. The strains differed decidedly in their susceptibility to the cacao moth. Comparable work conducted in Trinidad is also briefly discussed.

Propagation of citrus plants by stem cuttings, E. A. MENDOZA (*Philippine Agr.*, 18 (1929), No. 6, pp. 397-410, fig. 1).—Comparing the effect of bottom heat, changes in light intensity, humidity, potassium permanganate solution, and callusing as factors in the propagation of citrus cuttings, it was found that bottom heat was the most effective. A 3 per cent Dipdust solution proved a better disinfectant for cuttings than did a 10 per cent boric acid solution. High humidity was harmful by increasing fungus growth. Potassium permanganate in the strengths used apparently induced decay.

The double pummelo of Banda and Ambon, O. A. REINKING (*Jour. Heredity*, 20 (1929), No. 10, pp. 448-458, figs. 5).—Descriptive and historical notes are presented.

The coffees of the world.—I, General discussion, A. CHEVALIER (*Les Caféciers du Globe. I, Généralités sur les Caféciers*. Paris: Paul Lechevalier, 1929, pt. 1, pp. VIII+196, figs. 32).—A general discussion upon the coffee plant, its distribution, culture, etc.

Experiments with nitrogenous manures (review), T. EDEN (*Tea Quart. [Tea Research Inst. Ceylon]*, 2 (1929), No. 4, pp. 129-134).—A brief review of recent experimental work in India and Java on the fertilization of tea.

The Macadamia nut in Hawaii, W. T. POPE (*Hawaii Sta. Bul.* 59 (1929), pp. 23, figs. 9).—A general discussion concerning origin, botany, propagation methods, cultural requirements, fruiting, harvesting, composition, and uses. Analyses of the nuts are included.

Experimental work with gladiolus at the department of floriculture, Michigan State College, K. POST (*Gladiolus Rev.*, 7 (1930), No. 2, pp. 65-67).—Records taken on three varieties of gladiolus grown on soil which had been used the preceding year for tomatoes suggested that materials such as tankage, urea, nitrate of soda, and ammonium sulfate reduced the number of spikes cut and the number of flowers per spike, and in some cases tended to reduce the size of the corms as compared with those grown with well balanced fertilizer. Sheep manure delayed maturity and resulted in an increased proportion of small corms. Michigan peat applied in the row proved more valuable than did sheep manure. Superphosphate tended to hasten maturity in flowers and corms and was superior to bone meal as a source of phosphorus. The well balanced fertilizers gave the most satisfactory results.

Precocious lilac hybrids, F. L. SKINNER (*Jour. Heredity*, 20 (1929), No. 8, pp. 375-377, figs. 2).—Seedlings from crosses between the common lilac, *Syringa vulgaris*, and the Korean species, *S. dilatata*, blossomed when 3 years old but did not excel the common lilac in hardiness, despite the cold-resistant characteristics of the Korean parent. Hybrids between *S. vulgaris* and *S. velutina* formed blossom buds in their second summer.

Non-symbiotic germination of orchids, R. V. LA GARDE (*Ann. Missouri Bot. Gard.*, 16 (1929), No. 4, pp. 499-514, pl. 1).—In studies at the Missouri Botanical Garden it was found that the type of sugar used in the media and also the pH value of the media were important considerations in the growing of orchid seeds in flasks. Of the sugars used maltose was found most favorable for the germination and growth of *Cattleya*. The absence of sugar of any kind led

to practically negative results. In respect to pH value the best growth was secured between 4.8 and 5.2. At or above 5.6 germination and growth were retarded, and in most cases chlorosis followed.

Herbaceous perennials, I. PRESTON (*Canada Dept. Agr. Bul. 118, n. ser. (1929), pp. 70, figs. 89*).—Supplemented with lists of varieties for special purposes and districts, general information is presented on the characteristics, propagation, culture, and general care of ornamental flowering plants.

FORESTRY

Light and moisture in forestry, G. A. PEARSON (*Ecology, 11 (1930), No. 1, pp. 145-160, figs. 3*).—The importance of sunlight, both directly in stimulating sturdy growth and indirectly in increasing the temperature of the soil in the cool upper altitudinal ranges of the Southwest, was indicated in studies conducted by the U. S. D. A. Southwestern Forest Experiment Station of Flagstaff, Ariz. The average temperature for the five months, May through September, at a 12-in. depth for soil in full sunlight, 25 per cent shade, and 60 per cent shade was, respectively, 63, 56.4, and 54.7° F. Where the air temperature was too low for the best growth the author believes that the heat deficit may be made up by direct insolation. Furthermore, in very low light intensities but with adequate moisture it was observed that species tended to assume a slender, weak form.

Soil moisture is conceded to be the critical factor in the early life of forest seedlings, but after the roots have penetrated to a foot or more lack of moisture was manifested in slow growth rather than death. As shown in earlier experiments by the author (*E. S. R., 52, p. 345*), potted conifers of several species were found capable of surviving in a nearly dormant condition when the wilting point was approached. In the present study where competition of tree roots was relieved by trenching, trees in partial shade made but poor growth or succumbed, while those of the same age classes in near-by open spots made substantial growth.

Some aspects of soil moisture in the forest, I. J. CRAIB (*Yale Univ. School Forestry Bul. 25 (1929), pp. 62, pls. 7, figs. 10*).—Studies in the Yale Demonstration and Research Forest near Keene, N. H., in the summers of 1925 and 1926 showed that in this dominantly white pine region there is considerably more moisture present in the upper soil layers than in the lower, both in the open and in the forest. Soil moisture decreased consistently with increased depth down to at least 100 cm. (39 in.). The decline was rapid down to about 40 cm., below which the changes became more gradual. Soils in the open contained considerably more moisture during dry periods than did forest soils, with the differences greatest in the upper layers. Open soils were considerably denser than forest soils, and when based upon weight the latter had a much higher water-holding capacity.

Concerning wilting coefficients there was noted but little difference between the open and the forest soils. However, due to the concentration of organic and colloidal matter in the upper layers wilting coefficients were higher than in the lower layers. The maximum volume of available water that the soil could hold was 5 per cent greater in the forest than in the open, but forest soils because of their porous nature permitted seepage at a rate almost three times that occurring in the open.

Observations upon soil moisture in trenched and untrenched quadrats established beneath a canopy of white pines showed much more available moisture in the trenched areas from which roots of surrounding trees were cut off. In both the trenched and untrenched quadrats there was usually more moisture

available in the upper than in the lower layers. During summer drought the available soil moisture sometimes declined below that essential to support life in the lesser vegetation, thus accounting in part for the lack of ground flora under pine canopies. In spring and autumn when soil moisture was abundant the differences between the trenched and untrenched quadrats were slight.

The reaction of swamp forests to drainage in northern Minnesota, J. L. AVERELL and P. C. MCGREW ([*St. Paul*]: *Minn. State Dept. Drain. and Waters*, 1929, pp. 66, figs. 43).—This is a report on studies of the influence of drainage upon the growth of forest trees made cooperatively by the Minnesota State Departments of Drainage and Waters and of Forestry and Fire Prevention, the University of Minnesota, and the U. S. D. A. Forest Service and Bureau of Public Roads.

Grouping all species, it was found that in the 26 areas included in the study trees in undrained areas averaged 0.23 cord volume increment per acre per year as compared with 0.49 cord for trees in drained areas. Cedar made the greatest volume growth in the undrained areas and also responded best to drainage. The tamarack showed the least response to drainage. The effect of drainage dropped off markedly as the distance from the ditch increased, the benefited area averaging 331 ft. Observations on the acidity of the peat showed very high acidity on the poor sites in the case of spruce, with slight acidity on the good locations.

Effect of excessively high temperatures on coniferous reproduction, F. S. BAKER (*Jour. Forestry*, 27 (1929), No. 8, pp. 949-975, figs. 3).—Observations upon the seedlings of 13 species of conifers grown in receptacles containing dark adobe soil covered with a thin layer of coarse sand and exposed directly to a radiant electric heater so tilted that the rays struck the surface of the soil at an angle of 65° showed very definite relations between injury and the temperature within the seedlings, as determined by the electric thermocouple. The age of the seedlings and the species were also factors concerned in injury. Characteristics tending to reduce injury from heat were (1) large cotyledons, (2) short hypocotyls, (3) rapid development of the true leaves, (4) large stems, (5) rapid development of the endodermis and xylem, and (6) an early change of cortex from succulent to hard tissue.

The living tissue of seedlings from 1 to 3 months of age was quickly killed at 130° F. or higher but was able to withstand somewhat lower temperatures for some time. Heat injury ranged from a slight discoloration on the exposed surface to the complete killing of an entire ring and was rather difficult to distinguish from damping-off injury. Under the conditions of the experiment the tissues of the seedlings remained on the average from 15 to 20° cooler than the surface sand temperature, with a maximum difference of 42° and a minimum of 0. The temperature in the base of the seedling was evidently influenced very materially by the amount and position of the shade cast by the foliage. Hardening of the stem tissues tended to reduce injury as the plants became older.

Yields of second-growth spruce and fir in the Northeast, W. H. MEYER (*U. S. Dept. Agr., Tech. Bul.* 142 (1929), pp. 52, pls. 3, figs. 18).—Rated in given order of importance as sources of pulpwood in the Northeastern States are red spruce (*Picea rubra*), balsam fir (*Abies balsamea*), white spruce (*P. glauca*), and black spruce (*P. mariana*). For the first three species growth and volume tables are presented based on measurements taken in a series of sample plots scattered over northern New England. North and east of the White Mountains mixed stands of red and white spruce and balsam fir were common features of the second growth, while west and south of the main White Mountain range white spruce was almost entirely lacking and balsam fir less abundant. In old

fields and pastures evidence was found that grazing had been a factor in determining the nature of the subsequent stand. The subject matter is presented under two main divisions, the first including the tables and charts, with discussion of their use, and the second technical considerations concerning the character of the material and the reliability and limitations of the tables, etc.

General land cover, J. S. BORDNER and W. W. MORRIS (*Wis. Dept. Agr. and Markets Bul. 100* (1929), pp. 45-61, figs. 2).—Yield tables are presented for poplar (popple), mixed hardwoods, white pine, Norway pine, and jack pine as grown in Bayfield County, Wis., and general information is presented on the distribution of the species, composition of the stands, importance of forest products, etc.

Trees for Wyoming farmers and ranchmen (*Wyoming Sta. Circ. 22* (1929), pp. 4).—A revision of Circular 21 (E. S. R., 59, p. 534) and presenting in a like manner suggestions for planting, supplemented with a price list of available stock.

DISEASES OF PLANTS

[Report of the] department of plant pathology, G. A. NEWTON (*Western Washington Sta. Bul. 14-W* (1929), pp. 28-31, fig. 1).—In 82 per cent of the isolations made from areas of lettuce leaves just beginning to show spots of necrotic tissue, there were found neither fungi nor bacteria, and in the remaining 18 per cent bacteria alone were discovered. Inoculations made from the bacteria-infected plants gave rise to apparent infection in 53 per cent of the tests. Verticillium wilt of black raspberry was found in only one plantation. No bacterial canker appeared on tomato seedlings grown in clean seed beds from seed of severely affected plants, but the same seed in unchanged soil gave a large number of seedlings affected with canker, the result suggesting that the bacteria had lived over in the soil on plant refuse rather than on seed. Of several disinfection treatments used in the growing of geranium cuttings, spraying the cuttings with mercuric chloride solution immediately after setting gave the least rotting and the greatest percentage of healthy plants.

A survey of small fruit plantings showed streak disease and black raspberry mosaic in most of the black raspberry plantations examined. Red raspberry mosaic was found in about 50 per cent of the black raspberry plantations, and mild mosaic was found in about 75 per cent of the red raspberry plantings, with little damage noted. The true mosaic of red raspberries was rarely found, most of the plantings being free from this disease.

Aster wilt and aster yellows were found, and the stem nematode (*Tylenchus dipsaci*) was located in some English iris. Mosaic of bulbous iris was severe in some plantings.

Reports from the mycological department, E. S. SALMON and W. M. WARE (*Jour. Southeast. Agr. Col., Wye, Kent, No. 25* (1928), pp. 142-146).—An outline of advisory and educational work is followed by brief notes on hop downy mildew (*Pseudoperonospora humuli*), resistance or immunity of hop varieties to mold (*Sphaerotheca humuli*) and downy mildew, nettle (*Urtica dioica* and *U. urens*) downy mildews, apple scab spraying experiments, and fungicides against *S. humuli*, and a list of recent publications.

Discussion on "the fungicidal action of sulphur" (*Ann. Appl. Biol.*, 13 (1926), No. 2, pp. 308-318).—With some account of experimentation and interpretation, a discussion regarding the forms, combinations, and behavior of sulfur when used as a fungicide by E. S. Salmon, Goodwin, B. T. P. Barker, F. S. Aumonier, W. A. Roach, Brierley, Tattersfield, G. H. Coons, C. T. Gimingham, and G. H. Pethybridge is reported.

Investigations on the fungicidal action of sulphur, B. T. P. BARKER (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt. 1927, pp. 72-80*).—This progress report follows up that of Gimmingham and Wiltshire (*E. S. R.*, 45, p. 143), which indicated that all sulfur and polysulfide sprays depend for their lasting efficiency on a coating of sulfur over the plant; that there is no evidence either of effective solubility of sulfur or of the conversion by atmospheric agency of sulfur into a gas or a soluble derivative in fungicidally significant quantity; that sulfur could distribute itself over considerable distances in a form not distinctly gaseous or vaporous; and that sulfur in close proximity to a living fungus spore exercises upon it a definitely toxic influence. The state of knowledge to date has been summarized in the present article by the author, dealing with the movement of sulfur through space and the interaction between sulfur and the living plant.

Sulfur is dispersed continuously from any of the ordinary solid forms as very minute solid particles, this dispersive change being favored particularly by moisture and heat. (This behavior resembles that of gold, or of arsenic). Apparently the minute masses visible at the highest magnifications are aggregates of a still smaller original form. No evidence has been shown of its passing off in gaseous or vaporous form. Critical tests are indicated. The nature of the discharge and the force with which the particles are dispersed were not closely investigated, but a suggestive experiment is briefly described. It was found that in a vertically supported closed cylindrical glass tube, 3 in. in diameter and 5 ft. long, sulfur placed at the lower end showed itself in a coating of copper sulfide throughout the length of the tube on a copper chain suspended from the upper end.

In limited studies as to the supposed interaction between the plant and the particulate sulfur, definite, though not conclusive, indications of sulfureted hydrogen were obtained. It is apparent that active growth (as opposed to the winter condition) is a condition of clear reaction. The most intense reaction is shown by the youngest, most actively respiring leaves. The reaction is limited to areas furnished with stomata (underside in the strawberry leaf), and is equally vigorous in light or in darkness. The leaves should remain attached to insure the reaction. Apparently, leaf injury is not a factor. Tests give no evidence of the presence of sulfur derivatives other than sulfureted hydrogen. Like results were obtained with other plants, these representing the Gramineae, Rosaceae, and Ribesiaceae, but those with the strawberry have been the most striking.

As regards the interaction between the living fungus organisms, no evidence appeared to show that sulfur in the absence of the organism produced any toxic substance. Work on cultures of fungus mycelium grown in bulk and lightly dusted with sulfur in various forms proved the formation of sulfureted hydrogen by the lead acetate paper test carried out in a way somewhat similar to that described in the tests with sulfured leaves. It is not doubted that the sulfureted hydrogen produced is the direct result of interaction between the living organism and the sulfur.

The results and conclusions presented in this article are said to be at variance with those presented by Young (*E. S. R.*, 50, p. 345), whose work and conclusions are criticized.

Report on bunt prevention trials, 1927, R. M. NATTRASS (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt. 1927, pp. 104-106*).—As the result of these trials, carried out at three different places, looking to the prevention of wheat bunt, and using seed of Little Joss artificially contaminated with bunt spores and then treated with fungicides, it was concluded that while the pre-

ventive dressings used did control wheat bunt to a considerable extent, copper carbonate powder (2 oz. per bushel) is not quite so efficient as copper sulfate (solution, 2.5 per cent), or as formaldehyde (40 per cent solution, 1 part in 320).

Studies in cereal diseases.—III, Seedling blight and foot-rots of oats caused by *Fusarium culmorum* (W. G. Sm.) Sacc., P. M. SIMMONDS (Canada Dept. Agr. Bul. 105, n. ser. (1928), pp. 43, pls. 2, figs. 15).—In the present number of this series, the first two of which have been noted (E. S. R., 60, p. 149), a difficult seedling blight and foot-rot disease of oats caused by *F. culmorum* is defined. Though all cereals are attacked, oats probably suffer most severely. This trouble appears to be common in western Canada and adjacent parts of the United States, also in the Pacific Coast States. The losses, though hard to determine, are presumably great. The symptoms are divided into preemergence, seedling, and basal lesions. This account is descriptive and comparative.

Though *F. culmorum* resembles *Gibberella saubinetii* in the *Fusarium* stage of the latter, the former is distinguished by the invariable production of chlamydospores. *F. culmorum* cultures develop over a range of temperatures from 4 to 32° C., the optimum lying near 24 to 28°. After two years of drying in soil, a characteristic growth was obtained from conidia. Isolations (14) from various hosts and localities were pathogenic to wheat, oats, and barley. The fungus is either parasitic or saprophytic.

Initially it comes from the soil or seed. On plants grown at from 8 to 15° but little disease develops. At from 18 to 30° the progress is more rapid, with soil moistures of 20 and 35 per cent of saturation. Deep seeding (beyond 3 in.) increases the disease. Early seeding (cool soil) lessens attack.

Good control under greenhouse conditions was obtained with certain seed treatments, such as Semesan, Germisan, Uspulun, Tillantin, Segetan, Urania, and Dupont Dust No. 12. Formalin and sulfur did not control seedling blight. Seed treatments in the field tests compared quite favorably with the greenhouse tests, although at present they are not recommended as a control measure for general practice. Joannette, a variety of black oats, was the only one to give any indication of resistance.

Transgressive segregation for susceptibility to smut in an oat cross, R. J. GARBER, N. J. GIDDINGS, and M. M. HOOVER (Jour. Agr. Research [U. S.], 39 (1929), No. 12, pp. 953-962).—Evidence of transgressive segregation for susceptibility to smut in the Gopher × Black Mesdag oat cross already having been established,¹ data are herein offered from the West Virginia Experiment Station on the behavior of subsequent generations through the F₂. Resistance to smut was found apparently dominant and controlled by a single factor. This is accompanied by a modifying factor, which when associated with the homozygous condition for susceptibility in the other parent results in transgressive segregation.

Certain lines descendant from the cross showed distinctly greater susceptibility to smut than did the original susceptible parent, Gopher. The hypothesis is offered of linkage between the black color gene and the modifying factor which brings about transgressive segregations for susceptibility.

Smut control in cereals, P. H. STEWART and D. L. GROSS (Nebr. Agr. Col. Ext. Circ. 132 (1929), pp. 13, figs. 8).—In Nebraska, the enormous losses occurring annually from controllable cereal smuts are due to a reduction in acre yield, and, in wheat, also to a lowering of the grade, qualities, and market value of the crop. A simplified account is given of typical infection in seed.

¹ Breeding for Disease Resistance with Particular Reference to the Smut of Oats, R. J. Garber, N. J. Giddings, and M. M. Hoover. Sci. Agr., 9 (1928), No. 2, pp. 103-115.

flower, and field; also of wheat stinking and loose smuts, oat loose and covered smuts, barley loose and covered smuts, corn smut, and sorghum covered or kernel smut, with recommended treatments and methods of application.

Wheat smut in Montana, H. E. MORRIS and L. D. KURTZ (*Mont. Agr. Col. Ext. Bul.* 98 (1929), pp. 16, figs. 8).—This account, offering condensed information and practical guidance, places emphasis chiefly upon wheat stinking smut and upon the copper carbonate dust treatment, including apparatus for its use, with some discussion of other smuts, and of such treatments as copper sulfate, formaldehyde, and hot water. A tabulation is given of cereal smut diseases and of corresponding treatments (partly proprietary) and their application in case of wheat, oats, barley, maize, sorghum, and millet.

Relation of stomatal behavior to stem-rust resistance in wheat, H. HART (*Jour. Agr. Research [U. S.]*, 39 (1929), No. 12, pp. 929-948, figs. 3).—In a study at the Minnesota Experiment Station upon the influence of environmental factors on the stomatal behavior of varieties of wheat, it was found that stomatal movements follow a definite daily rhythm. The stomata open gradually after sunrise, close gradually during the afternoon, and remain closed through the night. The length of time that stomata were open varied sharply with varieties. The age of the tissue was also important, the stomata of the younger and more succulent parts opening earlier and remaining open longer than those of older parts. Since the critical period for stem rust infection is in the early morning and since the fungus enters through the stomata, early opening renders the plant more susceptible. Varieties ordinarily resistant in the field may be susceptible in the early seedling stages because of the earlier opening of stomata in young tissue.

Of the various factors, light, temperature, and moisture, concerned in the opening of cereal stomata, direct sunlight was found the most important. In greenhouse studies artificial light, excess moisture, and excess temperature failed to prolong the open period. From inoculation and histological studies the author concludes that rust germ tubes generally, if not always, enter the host through open stomata. It is thought that the fungus does not force entrance through the closed stomata.

Root rot and sclerotial diseases of wheat, L. S. SUBRAMANIAM (*Agr. Research Inst., Pusa, Bul.* 177 (1928), pp. 7, pl. 1, fig. 1).—Cultural investigations of a mycelial growth on sterilized parts of wheat seedlings from a field showing many dead plantlets developed a fungus which is described as the new species *Pythium graminicolum*.

A sclerotial disease of wheat is briefly reported in association with a fungus which proved to be identical with *Rhizoctonia destruens* (*Sclerotium rolfsii*).

Stem-rot of berseem caused by *Rhizoctonia solani* Kühn, M. TASLIM (*Agr. Research Inst., Pusa, Bul.* 180 (1928), pp. 8, pls. 2).—Studies since 1923 as to the causal organism of a disease of berseem (*Trifolium alexandrinum*) have shown this to be *R. solani*. *Vermicularia* sp. and *Fusarium* sp. both proved to be harmless saprophytes.

High moisture content favors the spread of the infection. The fungus forms sclerotia freely on glucose agar, potato slabs, and oatmeal agar. The perfect stage (*Corticium vagum*) was not found in any of the numerous cultures.

Comparative tests with chemical media against cruciferous clubroot [trans. title], H. BLUNOK (*Gartenbauwissenschaft*, 1 (1928), No. 2, pp. 154-176, figs. 6).—These tests on the control of *Plasmodiophora brassicae* in soil containing crucifers employed quicklime, formaldehyde, and several proprietary preparations. It is stated that the most favorable effect was obtained at a compara-

tively small cost with lime, which is considered the most satisfactory means available for the purpose.

Methods of studying the transmission of hop virus diseases [trans. title], C. BLATNÝ (*Ochrana Rošlin*, 8 (1928), No. 2-3, pp. 51-56, figs. 3; *Fr. abs.*, pp. 55, 56).—Of methods admitted to be practicable for use in studies on the transmission of virus diseases of hop, the author has preferred to use that of grafting, on account particularly of its practical value. A successful procedure is outlined.

A leaf spot and blight disease of onions caused by *Alternaria palandui* n. sp., C. RANGASWAMI AYYANGAR (*Agr. Research Inst., Pusa, Bul.* 179 (1928), pp. 14, pls. 2, figs. 3).—An onion leaf spot disease appearing at Coimbatore in December, 1926, and later, was found to be due to an *Alternaria*. This was studied comparatively and differentiated as a new form. As the Sanskrit name for onion is *palandu*, this new species was designated as *A. palandui*.

Onion immunity trials, 1927, R. M. NATTBASS (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.* 1927, p. 106).—In trials following up those previously noted (*E. S. R.*, 59, p. 242), onions from seed sown during the first half of August, 1926, on soil contaminated with *Sclerotium cepivorum*, were lifted June 3, 1927. The percentages of bulbs found to be diseased with *S. cepivorum* were for Lemon Rocco 4.3, White Globe 8.6, Italian Tripoli 11.4, Globe Tripoli 13.9, White Lisbon 25, and White Welsh 29.

Potato scab and late blight [trans. title], E. V. ABBOTT (*Estac. Expt. Agr. Soc. Nac. Agr., Lima, Circ.* 7 (1928), pp. 11, pls. 4).—Systematic information is briefly presented regarding potato powdery scab (*Spongospora subterranea*) and late blight (*Phytophthora infestans*), and also the usual measures to prevent or to lessen injury.

Sugarcane mosaic and its transmission [trans. title], E. V. ABBOTT and C. H. T. TOWNSEND (*Estac. Expt. Agr. Soc. Nac. Agr., Lima, Circ.* 5 (1928), pp. 10, pl. 1).—Though Peru is said to have been free to date from serious invasion by sugarcane mosaic, the main part of this paper is devoted to an account by Abbott of the history and geographical range of the disease, its causation, symptoms, harboring plants, and control. The development of resistant or immune varieties is thought to offer the chief reliance as regards protection. The short discussion by Townsend refers to the carrier, *Aphis maidis*.

Collar rot of apple trees, J. R. MAGNESS (*Washington Col. Sta. Bul.* 236 (1929), pp. 19, figs. 3).—Of various factors, such as fire blight, cultural injury, low temperature, and excessive moisture, that might cause collar rot injury of apple trees, winter injury is deemed the most important. Laboratory determinations of the killing point of sections of roots 0.75 to 3 in. in diameter indicated that temperatures slightly below 20° F. may seriously injure the roots near the crown. The heterogeneous nature of apple roots suggests the probability that considerable variation may exist in resistance to cold. Soil temperature readings taken in the orchard in midwinter showed minima as low as 19° at 4-in. depths.

Failure of wounds to heal is ascribed to unfavorable conditions, it being found that digging away the soil facilitated healing. Roots uncovered at Pullman in June and exposed throughout the summer withstood zero temperature in December with only little injury, while comparable roots freshly exposed and those uncovered in October were killed at temperatures of 17°. The removal of fruit from injured trees stimulated callus formation and healing of wounds.

The occurrence of *Phacidia discolor* Pot. in the Bristol Province, R. M. NATTBASS (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.* 1927, pp. 99, 100, pl. 1).—Referring to an account in his previous report (*E. S. R.*, 59, p. 239), the author describes a canker of headworked apple trees, showing

some correlation, as to incidence and severity, with a light type of soil and associated with *Fuckelia conspicua*, the conidial stage of *P. discolor*, not previously recorded for this area.

During the season now reported, this disease was observed on pear trees in a plantation in Worcestershire, consisting of mature trees from 15 to 20 years old of the variety Red Robin. All stages of the bark canker appeared, ranging from small discolored bark areas to definite cankers many inches in length, occasionally girdling and killing the laterals. On the younger cankers appeared the conidial fructifications of *F. conspicua* identical with those previously observed on apple trees. On the older cankers were apothecia agreeing with the description given by Potebnia (E. S. R., 27, p. 448) of *P. discolor*.

Apparently, the fungus does not attack healthy trees. In the first instance the attacks were confined to apple trees growing under adverse soil conditions which had been headed back. In the case of the pear, the only trees attacked were those of the variety Red Robin which had borne heavily for some years and possibly had reached the limit of productive growth on that soil. Inoculation with pure malt extract agar cultures failed to infect healthy young trees.

The spraying of cherry orchards against "leaf-scorch," W. GOODWIN, E. S. SALMON, and W. M. WARE (*Jour. Southeast. Agr. Col., Wye, Kent, No. 25* (1928), pp. 147-151, figs. 2).—The experience gained as the result of the trials outlined is claimed to show that with the use of a gun, such as is described in this article, it is possible to spray with Bordeaux mixture large trees (30 to 40 ft. high). In the case of the cherry varieties Early Amber, Waterloo, Amber, Victoria Black, Rivers. and Frogmore, no appreciable injury was caused to the foliage by the strength of the Bordeaux mixture, which was made up of 8 lbs. of copper sulfate and 8 lbs. of lump quicklime to 100 gal. of water and applied April 12 and May 10.

Further experiments on the control of the American gooseberry mildew, season 1927, R. M. NATTRASS (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt. 1927, pp. 101-103*).—These experiments continue those previously reported (E. S. R., 59, p. 645; 60, p. 450). As it was considered that the relative values of the hitting type of spray (ammonium polysulfide and soft soap, soda and soft soap, etc.) and of the protective type of spray (Bordeaux, Burgundy) had already been demonstrated, the 1927 trials tested powdered sulfur and a proprietary "colloidal" sulfur against the standard ammonium polysulfide. One series of trials was carried out by the adviser at Cheltenham, and another by the present author in collaboration with H. T. Horsfield at Knowle Hill, Evesham.

In the first series, under conditions very favorable to the disease, flowers of sulfur reduced the proportion by weight of mildewed berries from 69 to 5.8 per cent. Ammonium polysulfide applied once reduced the percentage by weight of mildewed berries to only 17.6. This result emphasizes the fact that the hitting spray must be applied more than once unless the weather conditions are very unfavorable to the disease. One application of colloidal sulfur gave promising results, this application appearing to act rather as a protective than as a hitting spray. It adhered for a considerable time to the foliage, with no signs of scorching.

In the second series, excellent control was obtained by the use of flowers of sulfur, ground sulfur, and green sulfur, the percentages by weights of mildewed berries being, for these respective forms, 3.1, 1, and 1.6. The colloidal sulfur treatment corresponded to a mildewed berry weight percentage of 6.7 and Amberene of 6.4, the control showing a weight percentage of 54.5 of mildewed berries.

Bacteriosis of gladiolus [trans. title], E. BAUDYŠ (*Ochrana Rostlín*, 8 (1928), No. 2-3, pp. 49-51, figs. 2; *Ger. abs.*, p. 51).—In the spring of 1928, the author noted in Moravia (Czechoslovakia) gladioli showing bacteriosis due to *Bacterium marginatum*. This disease is said to have appeared in Europe (France) first in 1894. The disease showed itself typically in the injuries to the bulbs, in agreement with the American descriptions, and in the spots of dying leaf tissue. The protective efficacy has been proved of bulb treatment with corrosive sublimate, Uspulun, and formaldehyde.

Studies in forest pathology.—I, Decay in balsam fir (*Abies balsamea*, Mill.), A. W. MCCALLUM (*Canada Dept. Agr. Bul. 104, n. ser.* (1928), pp. 25, pls. 7, fig. 1).—Balsam fir (*A. balsamea*) in Quebec is subject to a heart rot (red rot) due to *Stereum sanguinolentum* and two butt rots, one (feather rot) supposedly due to *Poria subacida* and the other (brown rot) to *Polyporus balsameus*. Red rot enters principally by way of branch stubs, and the butt rots chiefly through the roots. No relation was determined between the recent bud worm outbreak and the widespread decay in balsam fir. It is thought that from the statistical data presented in this article it should be possible to determine the proper cull factor to be used in allowing for decay. A direct relation was found to exist between age and decay.

Larch destruction and theory of canker formation, I [trans. title], R. FALCK (*Gartenbauwissenschaft*, 1 (1928), No. 1, pp. 53-70).—Larch canker is dealt with historically as in central Europe, where it appeared about 1850, or 100 years after larch culture became a feature of forests in Prussia. Climatic, insect, and disease factors are outlined.

Biological and practical researches into bluing in pine and spruce, T. LAGERBERG, G. LUNDBERG, and E. MELIN (*Svenska Skogsvårdsför. Tidskr.*, 25 (1927), Nos. 2, pp. 145-272, pls. 2, figs. 69; 4, pp. 561-739, figs. 24; *Swed. abs.*, pp. 692-739).—This investigation, begun in 1923 as a scientific research into the nature of bluing and its ecological conditions and as a practical study to ascertain the most suitable methods of storing timber to prevent bluing, soon showed that Hyphomycetes and Sphaeropsidaceae play a greater part as wood bluing fungi than Ascomycetes. This discovery necessitated a development of the inquiry on a much more comprehensive plan. Isolation tests were, therefore, made with timber from various parts of Sweden, including standing trees and sawn timber and lumber stored in yards. A study was made of decay and cracking and of other forms of damage. Evaporation was also studied, especially in summer-felled timber.

This account discusses previous statements as to the origin of bluing; forms and origin of discoloration; the appearance of bluing in the open and the possibilities of the dissemination of fungi; Swedish bluing fungi, including *Ceratostomella coerulea*, *C. piceae*, *C. pluriannulata*, *C. pini*, *Endoconidiophora coeruleascens*, *Sclerophoma entocyliina* n. sp., *Discula pinicola*, *D. pinicola mammosa*, *Hormonema dematioides* n. g. and sp., *Trichosporium tingens* n. sp., *Hormodendrum cladoporioides*, *H. microsporium* n. sp., *Leptographium lundbergii* n. g. and sp., *Cadophora fastigiata* n. g. and sp., *Alternaria humicola*, *Xylomyces* I, and *Penicillium bifforme*; and the influence of different factors upon the development of bluing fungi.

ECONOMIC ZOOLOGY—ENTOMOLOGY

College zoology, R. W. HESNER (*New York: Macmillan Co.*, 1929, rev. ed., pp. XXIII+645, pl. 1, figs. 553).—This is a textbook of zoology first issued in 1912 and revised in 1926.

The agricultural zoology of the Malay Archipelago, K. W. DAMMERMAN (*Amsterdam: J. H. de Bussy*, 1929, pp. XI + 473, pls. 41, figs. 182).—In this

work, which is in the main an English edition of the author's work published in 1919 and written in Dutch, the field has been extended from the Dutch East Indies to include economic insects and other animal pests of the Malay Peninsula and Philippine Islands. Following a brief introduction, reference is made to the work of official entomologists in this region. Chapter 1 deals with animal pests; 2 with soil fauna—termites and ants; 3 with internal plant parasites—borers; 4 with external plant parasites—biting animals; 5 with external plant parasites—sucking animals; 6 with stored product pests; 7 with mammals and birds; 8 with beneficial animals; and 9 with control of pests. A bibliography of 11 pages with 9 subheadings, a plant host index with the animals which attack each so far as mentioned, a systematic index, and an alphabetical index are included.

On the zoogeography of Java, K. W. DAMMERMAN (*Treubia [Buitenzorg]*, 11 (1929), No. 1, pp. 1-88, fig. 1).—This account includes lists of the mammals known from Java, by Dammerman; the birds of Java, according to the list of Java birds by M. Bartels, jr., and E. Stresemann; the reptiles from Java, after N. de Rooy, Indo-Australian Reptiles, I and II, 1915-17, revised by L. D. Brongersma; Amphibia from Java, after van Kampen, Indo-Australian Amphibia, 1928; the fresh water fishes occurring in Java, after Weber and de Beaufort, Indo-Australian Fishes, I-IV, 1911-1922, revised by L. F. de Beaufort; and the land and fresh water Mollusca from Java, by T. van Benthien Jutting, presented in six appendixes (pp. 33-88).

The question of tropisms, M. ROSE (*La Question des Tropismes. Paris: Presses Univ. de France, 1929, pp. VII+469, figs. 90*).—The first part of this work deals with experimental facts (pp. 1-357), the second part with general theories (pp. 358-436), and the third part with tropisms and general culture (pp. 437-464). An extended bibliography accompanies some of the chapters and is included with each part.

Some Colorado rodent and bird pests, with suggestions for control, W. L. BURNETT (*Colo. Agr. Col. Circ. 56* (1929), pp. 22, figs. 11).—This is a revision of Circular 39, previously noted (E. S. R., 51, p. 251).

Hibernation of the thirteen-lined ground squirrel, *Citellus tridecemlineatus* (Mitchell).—III, The rise in respiration, heart beat, and temperature in waking from hibernation, G. E. JOHNSON (*Biol. Bul. Mar. Biol. Lab., Woods Hole, 57* (1929), No. 2, pp. 107-129, figs. 6).—This is the third part of a contribution from the Kansas Experiment Station (E. S. R., 62, p. 151). It was found that the increase in respiration, heart beat, and temperature as shown in graphs is very gradual at first in waking in a cold room at from 0 to 8° C. (32 to 46.4° F.), whereas in a warm room of near 30° the process is more rapid from the first. Transference to a room of about 0° appears to stimulate waking in some but not in all torpid ground squirrels, and this temperature does not prevent hibernation.

British insectivorous bats and their prey, E. B. POULTON (*Zool. Soc. London, Proc., 1929, II, pp. 277-303*).—Included in this account is a report of observations on the insect food of the best-known British bats.

The nutritive activities of the California woodpecker (*Balanosphyra formicivora*), W. E. RITTER (*Quart. Rev. Biol., 4* (1929), No. 4, pp. 455-488, figs. 9).—This is a report of observations of the food habits of the California woodpecker.

Preventing birds from damaging greens, W. L. MCATEE (*Bul. U. S. Golf Assoc. Green Sect., 9* (1929), No. 9, pp. 154, 155).—A brief discussion of the problem.

Materials on the history of entomology down to Linnaeus, I, F. S. BODENHEIMER (*Materialien zur Geschichte der Entomologie bis Linné. Berlin: W.*

Junk, 1928, vol. 1, pp. X+498, pls. 24, figs. 155; rev. in *Nature* [London], 123 (1929). No. 3112, pp. 935-937).—In this volume entomology of the early oriental period, first taken up (pp. 11-46), is followed by that of European antiquity (pp. 47-114), of the Middle Ages (pp. 115-246), and of modern times down to Linnaeus (pp. 247-298). It includes numerous reproductions of early illustrations of insects, insect structure, etc.

[*Work with economic insects in Ohio*] (*Ohio State Hort. Soc. Proc.*, 61 (1928), pp. 84-92, 106-125).—The papers on economic entomology presented at the annual meeting of the Ohio State Horticultural Society, held at Columbus, January 30 to February 2, 1928, include the following: The Present Status of the Oriental Peach Moth as an Orchard Pest in Ohio, by L. A. Stearns (pp. 84-92). The Green Apple Aphis, by C. R. Cutright (pp. 106-114). The Codling Moth, by J. S. Houser and C. R. Cutright (pp. 115-122), and Present Aids to the Control of Vineyard Insects, by G. A. Runner (pp. 123-125).

[*Report of the department of entomology of the Western Washington Station*], W. W. BAKER (*Western Washington Sta. Bul.* 14-W (1929), pp. 10-16, fig. 1).—Reference is first made to the progress of the potato flea beetle project, most of the work with which was carried on in Grays Harbor County where its damage to the tuber first became of serious importance and which now occurs in Thurston, Mason, Pacific, Lewis, and Clarke Counties, and to a limited extent in others. The damage to tubers was first thought to be the work of the western potato flea beetle (*Epitrix subcornuta* Lec.), but later observations indicate that the common potato flea beetle is the principal source of injury to the tubers, although both species severely injure the foliage. There were found to be at least two full broods and perhaps a partial third. The adults were found feeding on cherry buds as early as April 4 and from the middle of April to the first of May become quite numerous in the potato fields. The larvae are found in the soil by the middle of June, the heaviest infestation occurring from about the middle of July to the first of August. Though larvae and pupae have been found in November and December, by far the greater majority winter as adults. An examination of potatoes in Mason County in December, 1927, indicated that potatoes planted before the middle of March and dug for early potatoes and those planted after July 1 and up until July 12 produced marketable tubers practically free from flea beetle damage.

The use of pryethrum products and nicotine dusts as means of control is considered too expensive except where the beetles are congregated in large numbers on the edge of the field or to protect such crops as beans and tomatoes and for use in the flower garden when dahlias are attacked. The use of Bordeaux and lead arsenate, the standard spray for flea beetles, has not prevented tuber injury sufficiently to warrant its use alone, although potato foliage is protected from 5 to 10 days and tomato foliage from 10 to 14 days. As Bordeaux has given nearly complete protection to the tops for from 5 to 10 days, it is recommended that the potatoes for the main crop be planted about the middle of June and then sprayed with Bordeaux at least twice, a week apart, as soon as the leaves begin to appear.

The raspberry fruit worm attracted considerable attention in 1927, 1928, and 1929 as a pest of loganberries and raspberries, the more serious injury being caused by the feeding of the larvae in the berry, although the adult also destroys a portion of the crop by eating the stamens and pistils. Clean cultivation especially in late summer and early fall, recommended as a control measure, has not been as effective as expected. Arsenical and fluosilicate dusts and arsenical sprays have not given satisfactory control. Nicotine dusts killed large numbers of the adults in 1928 even when a light application was

made, but in 1929 were not as effective and can not as yet be recommended. No explanation can be given for the fact that some fields are heavily infested throughout the picking season while others are practically free in the latter half.

Reference is made to cooperative studies of the microscopic tapeworm of chickens (*Davainea proglottina*) conducted during the past two years. The common garden slug (*Agriolimax agrestis*) and the reticulated slug (*Physaon andersoni*) were found to be carriers of the tapeworm in the cyst stage. *A. agrestis* is much more commonly but not as heavily infested as *P. andersoni*.

Reference is made to the occurrence of a number of strawberry insects, a preliminary study of which was commenced in the Grand Mound and Rochester districts.

Fifty-ninth annual report of the Entomological Society of Ontario, 1928 (*Ent. Soc. Ontario Ann. Rpt.*, 59 (1928), pp. 128, figs. 9).—The papers presented at the annual meeting of this society held at Ottawa in November, 1928 (E. S. R., 60, p. 843), include notes on the insects of the season 1928 in Prince Edward Island, by R. P. Gorham (pp. 7, 8); in Nova Scotia, by W. H. Brittain (pp. 8-10), and by F. C. Gilliatt (pp. 10-13); in New Brunswick, by R. P. Gorham, G. P. Walker, and L. J. Simpson (pp. 13-17); in Quebec, by C. E. Petch (pp. 17, 18); in Ontario, by W. A. Ross and L. Caesar (pp. 18-22); in Manitoba, by A. V. Mitchener and N. Criddle (pp. 22-26); in Saskatchewan, by E. McMillan (pp. 26-28); in Northern Alberta, by E. H. Strickland (pp. 28, 29); in Alberta, by H. L. Seamans (pp. 29, 30); in British Columbia, by E. Hearle (pp. 31-36); and around Vancouver, especially Point Grey, by G. J. Spencer (pp. 36-38). Other papers include The Present Status of Corn Borer Parasites in Canada, by A. B. Baird (pp. 38-40); Notes on the Life-History of the European Corn Borer in Ontario, by G. M. Stirrett (pp. 40-43); Corn Investigations in Relation to the European Corn Borer, by A. R. Marston (pp. 43-45); The Percentage and Number of European Corn Borers Wintering in the Parts of Corn Stalks Below the Surface of the Ground, by R. W. Thompson (pp. 46-49); The Corn Borer Situation in Ontario in 1928, by L. Caesar (pp. 49-52); A Method of Preparing Wax Entomological Exhibits, by A. A. Wood (pp. 52-55); The Laboratory Breeding of *Microgaster tibialis* Nees, by W. E. Steenburgh (pp. 55-57); Notes on Myiasis of the Urinary Passages Caused by Larvae of *Fannia*, by J. D. Detwiler (pp. 57-59); The Value of Trap Crops in the Control of the Wheat Stem Sawfly in Alberta, by H. L. Seamans (pp. 59-64); Notes on the Life History of the Oriental Peach Moth at Vineland Station, by T. Armstrong (pp. 65-80); Some Remarks on the Present Status of Insecticidal and Biological Control Investigations for the Oriental Peach Moth, *Laspeyresia molesta* Busck, by A. Peterson (pp. 80-86); Notes on the Red Spider on Bush Fruits, *T. telarius* L., by W. G. Garlick (pp. 86-93); The Apple Maggot Outbreak of 1926 to 1928, by L. Caesar (pp. 93-95); Six Years' Study of the Life History and Habits of the Codling Moth (*Carpocapsa pomonella* L.), by J. A. Hall (pp. 96-105); A Breeding Place of *Euphoria inda* Linn., the Bumble Flower Beetle, by G. J. Spencer (p. 106); Notes on the Biology and Life-History of the Mexican Bean Beetle in Ontario, by G. M. Stirrett (pp. 107-109); and The Entomological Record, 1928, by N. Criddle (pp. 110-124).

[Economic insects in Russia] (*Zashch. Rast. Vred. (Plant Protect.)*, [*Leningrad*], 6 (1929), No. 1-2, pp. 39-43, fig. 1; pp. 53-62, figs. 3; pp. 63-70, figs. 4; pp. 71-74, fig. 1; pp. 75-78, 207-210, 213-230).—The papers included in these contributions relating to insects of economic importance in Russia have the following translated titles: Are Thysanoptera Injurious Insects? by I. A. P. Shchelkanovtsev (J. P. Stshelkanovtzev) (pp. 39-43); Observations on the Nutri-

tion of *Euxoa segetum* Schiff. in the Kharkov and Poltava Districts, by R. G. Puzyrnyi (Puzyrnyj) (pp. 53-62); On the Occurrence of *Oscinella frit* L. on Wild Grasses, by A. N. Vasin (Vasin) (pp. 63-70); On the Parasitism of *Gonia* and *Cnephalia* in the Larvae of *Euxoa segetum* Schiff., by N. L. Sakharov (Sacharov) (pp. 71-74); The Armyworm, *Cirphis unipuncta* (Haw.), in the Russian Far East, by V. M. Engelhardt (Engelhardt) (pp. 75-78); Contributions to the Fauna of Bark Beetles of the Svyatogor Forests in the District of Izium, by N. Kostenko (pp. 207-210); Notes on the Biology of *Hyponomeuta malinellus* Zell., by K. S. Ruzaev (pp. 213-219); Notes on *Euxoa tritici* L., by P. V. Popov (pp. 221-223); Hymenopterous Parasites of the Family Ichneumonidae Reared at the Kuban Plant Protection Station in 1927, by N. A. Telenga (pp. 225, 226); On the Occurrence of *Schistocerca gregaria* Forsk. in the Armenian Republic, by M. I. Makarijan (Makarjan) (pp. 227, 228); and *Epicausta suavis* Haag., New to the Union of Socialistic Soviet Republics, by E. A. Kuznetsova (Kusnezov) (pp. 229, 230).

[Report of entomological work in Sierra Leone], E. HARGREAVES (*Sierra Leone Lands and Forests Dept. Ann. Rpt. 1928*, pp. 20-22).—A brief report of work with the more important insects of the year.

[Administration reports of the entomological section for the years 1926-27 and 1927-28], K. KUNHIKANNAN (*Mysore Dept. Agr. Rpts. 1926-27*, pt. 2, pp. 23-25; 1927-28, pt. 2, pp. 29-34).—The usual annual reports (E. S. R., 57, p. 655).

Entomology, O. H. SWEZEY (*Hawaii. Sugar Planters' Assoc. Proc.*, 47 (1927), pp. 94-106).—A report of the occurrence of and work during the year with the more important insects and other animal pests in Hawaii.

Insect enemies of rice in Madagascar [trans. title], C. FRAPPA (*Riz et Rizicult.*, 3 (1929), No. 4, pp. 167-184, pl. 1, figs. 5; *Eng. abs.*, p. 187).—A summary of information on the insect enemies of standing and stored rice in Madagascar. Stored rice is more particularly invaded by the rice weevil, *Tribolium navale*, and the Angoumois grain moth.

Soil insects attacking sugar cane in Cuba, C. F. STAHL and L. C. SCARAMUZZA (*Trop. Plant Research Found. [Wash., D. C.] Bul.* 10 (1929), pp. 19, figs. 18).—A practical summary of information on the more important soil insects attacking sugarcane in Cuba.

The insect enemies of coffee in Cuba [trans. title], S. C. BRUNER (*Cuba Estac. Expt. Agron. Circ.* 68 (1929), pp. 38, pls. 12).—This account of the more important insect enemies of coffee in Cuba deals in particular with *Coccus viridis* (Green) (pp. 10-22). Other insects of major importance considered include the hemispherical scale, black scale, citrus black fly, *Leucoptera coffeella* Stainton, and *Apathe carmelita* (Fab.). Mention is also made of a number of pests of minor importance.

The cultivation of lac in the plains of India (*Laccifer lacca* Kerr), C. S. MISRA (*Agr. Research Inst., Pusa, Bul.* 185 (1928), pp. [51]+III+116, pls. 29, figs. 37).—This account replaces Bulletin 142, previously noted (E. S. R., 49, p. 851). It includes an account of the enemies of lac, of which particular mention is made of the predators *Eublemma amabilis* Moore, *Holcocera pulverea* Meyr., and *Pyroderces falcatella* Stain.

Notes on some insects and other arthropods affecting man and animals in Colombia, L. H. DUNN (*Amer. Jour. Trop. Med.*, 9 (1929), No. 6, pp. 493-508).—This is a report of observations made during the years 1923 and 1924 while engaged in campaigning against yellow fever in Colombia.

Insects, ticks, mites, and venomous animals of medical and veterinary importance.—Part I, Medical, W. S. PATTON and A. M. EVANS (*Croydon, Eng.: H. R. Grubb, 1929*, pp. X+786, pls. [61], figs. [377]).—This is said to be the

first of a series of four parts of a work dealing with the subject, each complete in itself. The present part consists of a course of 28 meetings which include demonstrations and laboratory work, explanatory notes, and drawings.

Preliminary observations on the polyhedral diseases of insects, G. F. WHITE (*Jour. Parasitol.*, 16 (1929), No. 2, p. 107).—This progress report of studies under way is the author's abstract of a paper presented at the fifth annual meeting of the American Society of Parasitologists, held at Des Moines, Iowa, in December, 1929.

Cryolite and barium fluosilicate: Their use as insecticides, S. MARCOVITCH and W. W. STANLEY (*Tennessee Sta. Bul.* 140 (1929), pp. 19, figs. 8).—The authors conclude that among the fluorine compounds which best meet the requirements of a stomach poison (1) cryolite, which is a fluoride of aluminum and sodium, and (2) barium fluosilicate, offer the most promise at the present time. Not only do these materials have a comparatively low solubility and are reasonably safe on foliage but they may be obtained in commercial quantities at about the same price as lead arsenate. Both are highly toxic to insects, but in the small quantities used on plants the fluorine compounds so far as known are not dangerously poisonous to man.

For adult insects barium fluosilicate is more toxic than cryolite, but both materials gave excellent control of the Mexican bean beetle when used as a spray at the rate of 1 lb. to 50 gal. of water. At the rate of 6 lbs. to the acre neither cryolite nor barium fluosilicate used as a dust caused foliage injury on beans. Thirty lbs. or more to the acre produced moderate burning. Five weekly dustings on tobacco produced no foliage injury with either material and controlled the hornworms and flea beetles. Fish oil, used at the rate of 25 per cent of the weight of cryolite or barium fluosilicate, materially aided the sticking qualities. Both cryolite and barium fluosilicate, used in the dust form at the rate of 6 lbs. to the acre, gave very good control of the bean beetle. These materials were also used successfully when mixed with two parts of lime.

Triethanolamine oleate for oil sprays, G. L. HOCKENYOS (*Indus. and Engin. Chem.*, 21 (1929), No. 7, pp. 647, 648).—The experiments conducted indicate that an excellent miscible oil may be made by boiling 5 parts of oleic acid with 6 parts of "Commercial Triethanolamine" and adding 15 parts of free oleic acid and 5 parts of alcohol. "This may then be dissolved in up to 40 parts of light or 100 parts of heavy paraffin oil. Preliminary experiments show no injury to plants other than the oily gloss which usually results from oil sprays. Good kills on mealybug and red spider resulted both with oil emulsion alone and with oil emulsions having *p*-dichlorobenzene or carbon tetrachloride dissolved in the oil. The only plant injury was due to excessive dosage of the light flushing oil, which is not so highly refined as the other two oils.

"The most promising method of using the very light oils seems to be to make a solution of 3 parts of Triethanolamine, 4 parts oleic acid, 6 parts carbon tetrachloride, and 30 parts of oil. Such a solution is uniform though rather cloudy. It does not settle out or separate for several days and, although not miscible in water, it is very easily emulsified."

Pollination of hardy fruits: Insect visitors to fruit blossoms, G. F. WILSON (*Ann. Appl. Biol.*, 16 (1929), No. 4, pp. 602-629, fig. 1).—The author's studies, extending over a period of five years, have emphasized the importance of the hive bee as a pollinating agent, although the work of pollination under certain conditions may be carried out entirely by wild insects, principally bumble and other wild bees (*Bombus* and *Andrena*) and flies (*Eristalis*, *Syrphus*, *Sciara*, anthomyiids, and *Calliphora*).

Control of grasshoppers by use of poisoned bran mash and egg bed cultivation. C. A. HENDERSON (*New Reclam. Era* [U. S.], 20 (1929), No. 11, p. 173).—A brief discussion of control work in the reclaimed Tule Lake bed in southern Oregon and northern California.

Western leaf-footed plant bug, *Leptoglossus zonatus*, H. J. QUAYLE (*Calif. Citrogr.*, 14 (1929), No. 4, p. 125, figs. 2).—A brief account of this plant bug, which appeared in large numbers in two or three restricted areas in the vicinity of Brawley, Imperial County, Calif. The pomegranate is its favorite host, from which it attacks the citrus near by. When a dozen or more individuals occur on a single orange the extraction of its juice causes the fruit to drop, and the same is particularly true of the tangerine.

The beet leaf bug (*Piesma quadrata* Fieb.), J. WILLE (*Die Rübenblattwanze (Piesma quadrata Fieb.)*, Berlin: Julius Springer, 1929, pp. [3]+116, figs. 39; rev. in *Ann. Appl. Biol.*, 16 (1929), No. 4, p. 645).—A report of *P. quadrata*, a lace bug enemy of the sugar beet in Germany. This pest is of importance due to its transmission of the causative agent of leaf curl, a disease that has appeared and is spreading in Germany and which in many respects is similar to though not identical with the curly top disease of sugar beets occurring in the United States. The synonymy and systematic position of the pest, its food plants, geographical distribution, morphology, biology, transmission of leaf curl disease, and means for controlling the pest and preventing the disease are dealt with. A list of 65 references to the literature is included.

The review is by J. H. Smith.

Observations on the injury caused by Toxoptera graminum Rond (Homoptera: Aphididae), F. M. WADLEY (*Ent. Soc. Wash. Proc.*, 31 (1929), No. 7, pp. 130-134).—This is a report of observations made at the Minnesota Experiment Station. It is thought that the secretion of a chlorophyll-destroying enzyme may contribute largely to the economic importance of the green bug.

Contribution to the study of the Coccidae of North Africa, I-V [trans. title], A. BALACHOWSKY (*Ann. Soc. Ent. France*, 96 (1927), No. 2, pp. 175-207, figs. 17; *Bul. Soc. Hist. Nat. Afrique Nord.*, 26 (1928), No. 3, pp. 121-144, pls. 3, No. 4, pp. 156-180, pl. 1, figs. 2; *Bul. Soc. Ent. France*, No. 17, (1928), pp. 273-297, figs. 8; *Mém. Agr. [France]*, *Ann. Epiphyties*, 14 (1928), No. 4, pp. 280-312, figs. 18).—The first contribution consists of an annotated list of 106 forms in connection with a 3-page bibliography, to which are added descriptions of 5 new species; the second consists of descriptions of 6 new species and a further list of 25 forms; the third deals with the biology and means of control of *Ohrysomphalus aonidum* L.; and the fourth consists of descriptions of 2 new species and notes on 5 additional forms. The fifth contribution deals with the natural enemies of the Coccidae in North Africa, particularly the predatory Coleoptera and parasitic Hymenoptera, and includes notes on several species of Lepidoptera, a single dipteran, a neuropteran, and a bibliography of 27 titles.

Notes on reproduction in *Aspidiotus hederæ* (Coccidae), F. SCHRADER (*Psyche*, 36 (1929), No. 3, pp. 232-236, figs. 4).—This is a report of studies of the biology of the oleander scale (*A. hederæ*).

The pathogeny of muscardine of the silkworm [trans. title], A. PAILLOT (*Compt. Rend. Soc. Biol. [Paris]*, 100 (1929), No. 5, pp. 353, 354).—A study made of the penetration of the body of the silkworm by *Beauveria bassiana*, the causative agent of muscardine, is reported upon.

[Sugarcane borers] (*Trop. Agr. [Trinidad]*, 6 (1929), Nos. 8, pp. 224-226; 11, pp. 310-312; also in *Planter and Sugar Manfr.*, 83 (1929), No. 19, pp. 344-

346).—The first paper, by R. W. E. TUCKER, deals with control measures in Barbados, including methods of breeding parasites. The second, by J. G. MYERS, deals with some recent work on parasites of the small moth borers.

Life history notes on *Lamprosema indicata* (Pyralidae), a caterpillar pest of chrysanthemums, M. C. CHEERIAN (*Jour. Bombay Nat. Hist. Soc.*, 33 (1929), No. 4, pp. 857-860).—This is a short account of the life history and habits of an enemy of chrysanthemums and means for its control as studied at the insectary at Coimbatore, India.

Control of the codling moth (*Cydia pomonella* Linn.), G. T. LEVICK (*Jour. Dept. Agr. Victoria*, 27 (1929), No. 9, pp. 533-542, figs. 4).—This is a report of control work conducted in Victoria, in which State the loss due to the moth is estimated at 7 per cent of the apple crop, although at Harcourt, the chief apple-growing center in northern Victoria, the average loss is at least 15 per cent. Experiments in New South Wales have shown the value of summer spraying oil as an ovicide. The average results for the preceding two years were for arsenate of lead 36 per cent infestation and for arsenate of lead calyx sprays followed by white oil 12 per cent infestation.

A new aegeriid on cowpea from Brazil (Lepidoptera: Aegeriidae), A. BUSCK (*Ent. Soc. Wash. Proc.*, 31 (1929), No. 7, pp. 134-136, 137, figs. 4).—Under the name *Aegeria vignae* n. sp. the author describes a new lepidopteran, the larva of which attacks the stems of the cowpea and other cultivated leguminous plants in Bahia, Brazil.

The forleule or pine noctuid (*Panolis flammea* Schiff.), H. SACHTLEBEN (*Die Forleule (Panolis flammea Schiff.)*. Berlin: Julius Springer, 1929, pp. [4] + 160, pl. 1, figs. 35; rev. in *Ann. Appl. Biol.*, 16 (1929), No. 4, pp. 644, 645).—This is a report of studies of a noctuid moth that is the occasional cause of serious damage to *Pinus sylvestris*, outbreaks in Germany having been traced back to the year 1725. A chronological history of the occurrence of this moth, first presented, is followed by discussions of its systematic position, geographical distribution, morphology, biology, parasites, other animal enemies and diseases, economic importance, and control measures. An extended account given of its parasites and hyperparasites includes a catalogue of parasitic Hymenoptera and Diptera.

It was found that calcium arsenate and sodium fluosilicate dusts are effective, and that the chalcid parasites *Trichogramma evanescens* and *Pteromalus alboannulatus* attack the eggs and pupae, respectively, and are not destroyed by the dusting.

An 11-page list of references to the literature is included, as is a colored plate illustrating the several stages in the insect's development.

The review is by A. D. IMMS.

Outworms on golf greens, W. R. WALTON (*Bul. U. S. Golf Assoc. Green Sect.*, 9 (1929), No. 9, pp. 156, 157, fig. 1).—A brief practical account devoted particularly to control of cutworms by use of poison bran mash.

Bionomic notes on some parasites of *Achatodes zeae* Harris (Noctuidae, Lep.) and *Phlyctaenia tertialis* (Guen.) (Pyralidae, Lep.), W. V. BALDUF (*Ohio Jour. Sci.*, 29 (1929), No. 5, pp. 218-242).—This is an account of the parasites of the elder borer (*A. zeae*) and the elder leaf tyer (*P. tertialis*), based upon observations made at Oakharbor, Ohio, and Urbana, Ill., in 1927 and 1928.

The geographical distribution of the malaria carrying mosquitoes, H. W. KUMM (*Baltimore: Amer. Jour. Hyg.*, 1929, pp. III + 178, figs. 39).—This, the tenth in the monographic series of the journal, consists of a collection of material recorded in the literature and in personal communications to the author. A bibliography of 397 titles is included.

Additional notes on the infection of *Anopheles* with malaria parasites. W. V. KING (*Amer. Jour. Hyg.*, 10 (1929), No. 3, pp. 565-579, fig. 1).—The author has found 10 of 12 tertian gametocyte carriers and 5 of 6 estivo-autumnal carriers to produce infections in *Anopheles*. "Of the mosquitoes fed on the infective cases of both types, 260 specimens were dissected and 133, or 51.2 per cent, were positive, with a range of from 11.1 per cent to 94.4 per cent in different lots. Two hundred and two of the dissected specimens were *A. quadrimaculatus*, 39 were *A. punctipennis*, and 19 were *A. crucians*. Certain differences were noted in the per cent of infections between the three species of *Anopheles* and between the two species of *Plasmodium*."

On the development of malaria parasites in the mosquito. W. V. KING (*Amer. Jour. Hyg.*, 10 (1929), No. 3, pp. 560-564, pls. 7).—The author here presents numerous photomicrographs of the sporogenic or sexual cycle of malaria parasites.

The story of the Mediterranean fruit fly. M. H. WALKER (*Tampa, Fla.: Florida Grower*, 1929, pp. 39, pls. 8, fig. 1).—This work includes an account, by W. Newell, of the eradication work with the Mediterranean fruit fly, and accounts of the early history of the fruit fly, its discovery in Florida, how to recognize the fruit fly, its life cycle and habits, host fruits and vegetables, etc.

The Mediterranean fruit fly in Hawaii, compiled by J. L. DWIGHT (*Hawaii. Forester and Agr.*, 26 (1929), No. 3, pp. 113-116).—The occurrence of and work with this pest in Hawaii is briefly reviewed.

Fruit-fly control. L. B. RIPLEY and G. A. HEPBURN (*Farming in So. Africa*, 4 (1929), No. 43, pp. 345, 346, 357, fig. 1).—The authors deal with attractants, repellents, and traps for the Natal fruit fly *Pterandus rosa* (Koh.).

Scientific survey of Porto Rico and the Virgin Islands.—Vol. XI, pt. 1, Insects of Porto Rico and the Virgin Islands: Diptera or two-winged flies, C. H. CURRAN (*New York: N. Y. Acad. Sci.*, 1928, pp. 118, figs. 39).—This work includes a key to the families; an annotated list of the forms met with in Porto Rico arranged by families, of which 34 are represented; keys to the genera and species of many of the families; a list of species previously reported from Porto Rico but not represented in the collection examined by the author; and a bibliography of 19 titles. Numerous species are described as new.

Some notes on the economy of cockchafer beetles. E. JARVIS (*Queensland Bur. Sugar Expt. Stas. Bul.* 20 (1929), pp. 49, pls. 6, figs. 3).—Included in this account is a discussion of the economic value of certain Queensland parasitic insects, including *Apanteles nonagriæ* Oliff., the earwig *Labia* sp., the ground beetle *Chalaenius australis* Dej., *Campsomeris tasmaniensis* Sauss., and *C. radula* Fab.; the early stages of *Macrosciagon* (*Eumenadia*) *cucullata* Macl.; and factors favorable to the increase of digger wasp parasites. Notes are presented on some melolonthid beetles attacking sugarcane and on the habits and coloration of some Queensland Rutellinae.

Field studies of the physical ecology of the alfalfa weevil. H. L. SWEETMAN (*Wyoming Sta. Bul.* 167 (1929), pp. 32, figs. 6).—This is a report of studies conducted at the field station located at Casper.

It was found that the temperatures of the alfalfa stems, leaf surfaces, and growing tips were very close to those of the surrounding air. The soil surface in alfalfa fields, when exposed to the sun, often reached from 50 to 60° C. unless the soil was quite moist. The mean daily temperatures of the air for the 10-hour periods at the 3.5-ft. level averaged from 2 to 2.6° above those secured among the plants during May, June, and July, while the mean daily temperatures for the 24-hour days were very similar at the different levels. The removal of a crop of hay was found to produce temperature changes near

the ground which may be extremely disastrous to immature stages of the weevil.

The relative humidity during the day was much greater among the plants than at 3.5 ft. above the ground. During the night the humidity among the plants was very high and often reached 100 per cent. This shows a wide variation from the conditions that would be indicated by the use of the U. S. D. A. Weather Bureau records taken 3.5 ft. above the ground. Precipitation records give very inaccurate information regarding the moisture conditions in alfalfa fields during the season that irrigation water is being supplied.

The adult weevils became active when the temperature reached from 10 to 12°. Very few adults were found on the soil surface when the surface temperature increased to 35° or higher. No response of the adults to moisture, light, and air currents was observed, and no evidence of flight by the alfalfa weevil has been observed in the field. The examination of stems in the field showed that 93 per cent of the egg clusters were placed in green stems, 6 per cent in dead standing stems, and 1 per cent in dead fallen stems (rubbish). Thirty-six per cent of the clusters contained from 6 to 9 eggs, and 63 per cent contained from 3 to 12 eggs. Most of the eggs were deposited in the stems near the crown. Ninety-one per cent were placed within 6 in. and 79 per cent within 3 in. of the crown, and 85 per cent were deposited in hollow stems. Hollow stems that are easy to penetrate seemed to be especially attractive places for oviposition. The larvae secluded themselves in the growing tips and axils of the plants when the alfalfa was disturbed by wind and rain. The larvae concentrate near the tops of the plants as long as food is available.

The parasites of some weevils and bark beetles [trans. title], G. FUCHS (*Ztschr. Wiss. Biol., Abt. F, Ztschr. Parasitenk.*, 2 (1929), No. 2, pp. 248-285, figs. 36).—This paper deals with the nematode parasites of beetles of the genus *Pissodes* Germ., of *Hyllobius piceus* DeG., of *Hylastes ater* Payk., of *H. cunicularius* Er., and of *Hylurgus ligniperda* F., with a list of 25 references to the literature. Descriptions are given of *Allantonema picei* n. sp., *Tylenchus contortus laricis* n. sp., *T. dispar cinereus* n. sp., and of *T. contortus typographi* Fuchs and its free-living generation.

Practical queen rearing, F. C. PELLETT (*Hamilton, Ill.: Amer. Bee Jour.*, 1929, 4. ed., rev., pp. [VII]-9-104, figs. [51]).—This is a fourth, revised edition of the work previously noted (*E. S. R.*, 40, p. 264).

Paper wasps (Polistes) as pests in bird houses, W. L. MCATEE (*Ent. Soc. Wash. Proc.*, 31 (1929), No. 7, p. 136).—A report of observations made in the course of cooperative work by the U. S. D. A. Bureaus of Biological Survey and Plant Industry and aimed at increasing the number of birds in the experimental chestnut orchard at Bell, Md. In the season of 1928, 99 bird boxes were available, of which 40 had one or more nests of Polistes in them. Tearing the nests down and removing them from the houses was the only remedy found to be of any account, and this operation had to be repeated two, three, or even four times to achieve lasting success.

A revision of the Indo-Australian and Ethiopian species of the genus *Microgaster* (Hym. Bracon.), D. S. WILKINSON (*Ent. Soc. London, Trans.*, 77 (1929), pt. 1, pp. 99-123, figs. 7).—In this revision the author recognizes 24 species of the parasitic genus *Microgaster*, 13 of which are described as new. A number of species unknown to the author are listed, and a host list is included.

Successful importation of five new natural enemies of citrophilus mealybug from Australia, H. COMPERE (*Calif. Citrogr.*, 13 (1928), No. 9, pp. 318, 346-349, figs. 8).—This is an account of the introduction of natural enemies of the citrophilus mealybug, both predators and parasites, representing the genera

Coccophagus, *Diplosis*, *Anusoidea*, *Tetracnemus*, and *Chrysopa*, from Australia into California.

[Contributions on hymenopterous parasites] (*Ann. Soc. Ent. France*, 96 (1927), Nos. 1, pp. 63-76, figs. 9; 2, pp. 113-146; 3-4, pp. 263-269).—The contributions here presented are as follows: Observations on the Ichneumonidae (second series). by A. Seyrig; Studies of the Biology of Insect Parasites: Parasitic Life and the Morphologic View of Adaptation, by W. R. Thompson and H. L. Parker; and The Mating of Hymenopterous Parasites, by P. Voukassovitch.

The western grass-stem sawfly, a pest of small grains, C. N. AINSLIE (*U. S. Dept. Agr., Tech. Bul.* 157 (1929), pp. 24, figs. 16).—This is a revision of and supersedes Department Bulletin 841 (E. S. R., 43, p. 259).

Nucleolar phenomena during oogenesis in certain Tenthredinidae, R. A. R. GRESSON (*Quart. Jour. Micros. Sci.* [London], n. ser., 73 (1929), No. 290, pp. 177-195, pl. 1, fig. 1).—This is a report of work undertaken with a view to determining the nature of the nucleolar buds described in a recent paper on sawfly oogenesis.

Can the nymph of *Dermacentor reticulatus* infect horses with piroplasmosis? [trans. title] A. W. BIELITZER (*Zentbl. Bakt. [etc.]*, 1. Abt., Orig., 112 (1929), No. 6-8, pp. 439, 440; abs. in *Rev. Appl. Ent.*, 17 (1929), Ser. B, No. 10, pp. 201, 202).—The author's investigations have led to the conclusion that the nymphs of *D. reticulatus* do not usually infest horses or other large animals in nature and that *Piroplasma caballi* is transmitted from a tick to its offspring, is preserved in them, and can only be transmitted to a horse by the adult tick.

An adult form of *Thrombicula autumnalis* Shaw [trans. title], M. ANDRÉ (*Compt. Rend. Acad. Sci. [Paris]*, 189 (1929), No. 15, pp. 545-547, fig. 1).—The adult form of this mite is described and illustrated.

Woolly mites (*Eriophyes gossypii*) on cotton: Its status and economic importance in Gujarat, B. J. THAKAR and M. H. DESAI (*Agr. Jour. India*, 24 (1929), No. 3, pp. 175-182, pls. 2).—An account of studies of a mite responsible for a 30 per cent reduction in seed cotton by seriously affected plants in Gujarat, India.

The spiders of Porto Rico.—Part II, *Trionycha* (Dictynidae to Mime-tidae), A. PETBUNKEVITCH (*Conn. Acad. Arts and Sci. Trans.*, 30 (1930), pp. 159-355, figs. 240).—This second part of the work previously noted (E. S. R., 60, p. 852) deals with the *Trionycha* from Dictynidae to Mimetidae.

Comparative investigations of the fowl cestodes of the genus *Raillietina* Fuhrmann 1920 [trans. title], R. LANE (*Ztschr. Wiss. Biol., Abt. F, Ztschr. Parasitenk.*, 1 (1929), No. 4-5, pp. 562-611, figs. 27).—A list of 52 references to the literature is included in this account.

ANIMAL PRODUCTION

[Animal husbandry investigations at the Canadian experimental stations and farms] (*Canada Expt. Farms, Rpts. Supts.* 1928, Agassiz (B. C.) Farm, pp. 4-7, 8-15, 34-37, fig. 1; Brandon (Man.) Farm, pp. 4-7, 8-13, 42-47, figs. 4; Charlottetown (P. E. I.) Sta., pp. 5-11, 46-53, figs. 2; Fredericton (N. B.) Sta., pp. 4-14, 38-49, figs. 2; Indian Head (Sask.) Farm, pp. 3-8, 46-48, fig. 1; Kapuskasing (Ont.) Sta., pp. 4-14, 58-56; Kentville (N. S.) Sta., pp. 6-10, 58, 59; La Ferme (Que.) Sta., pp. 5-10, 45-53; Lennorville (Que.) Sta., pp. 4-18, 51-63, figs. 2; Lethbridge (Alta.) Sta., pp. 5-24, 55-60; Morden (Man.) Sta., pp. 5-8, 51-59; Nappan (N. S.) Farm, pp. 5-25, 56-66; Rosthern (Sask.) Sta., pp. 4-14, 41-43; Scott (Sask.) Sta., pp. 5-17, 57-62, figs. 4; Sidney (B. C.)

Sta., pp. 4-6, 33-40, figs. 3; *Ste. Anne de la Pocatière (Que.) Sta.*, pp. 3-15, 51-57; *Summerland (B. C.) Sta.*, pp. 46-57, figs. 4; *Swift Current (Sask.) Sta.*, pp. 4, 5, 50).—In these publications (E. S. R., 60, p. 564) brief reports are given by W. H. Hicks, M. J. Tinline, J. A. Clark, C. F. Bailey, W. H. Gibson, S. Ballantyne, W. S. Blair, P. Fortier, J. A. McClary, W. H. Fairfield, W. R. Leslie, W. W. Baird, W. A. Munro, G. D. Matthews, E. M. Straight, J. A. Ste. Marie, W. T. Hunter, and J. G. Taggart, respectively, on the results of feeding and breeding experiments with horses, beef and dairy cattle, sheep, swine, and poultry.

The calcium and phosphorus content of some Quebec hays, R. HOLCOMB (*Sci. Agr.*, 10 (1929), No. 1, pp. 23-34, fig. 1).—A comparison of the mineral content of various samples of hay is presented in this paper from Macdonald College, Canada. Samples of 9 timothy hays varied in calcium content from 0.04 to 0.205 per cent, while 4 clover hays varied from 0.95 to 1.227 per cent. The phosphorus content of 6 timothy hays varied from 0.08 to 0.17 per cent and of 4 clover hays from 0.134 to 0.193 per cent.

A criticism of the Official method of determining phosphorus in hays is presented, together with a description of a convenient and cheap constant temperature bath for use in such determinations.

The effect of fertilizers upon the forms of phosphorus and the amounts of phosphorus, nitrogen, and silica in hays, T. H. MATHER (*Sci. Agr.*, 10 (1929), No. 1, pp. 35-63, figs. 3).—Analyses of forage crops at the University of Alberta, Canada, showed that very large increases in total phosphorus of plants were obtained by heavy applications of phosphate fertilizer as compared with check plats receiving no fertilizer. Practically the entire increase in total phosphorus of hays was in the inorganic fraction. A maximum yield of hay per acre was obtained with a 200-lb. application of treble superphosphate, while a 1,000- to 2,000-lb. application was necessary to obtain an extremely high phosphorus content in the plants. This indicates that phosphate needed in a ration in excess of the quantity present can be more economically supplied directly to the feed rather than by heavy applications of fertilizer to increase the phosphorus content of the hay.

The silica content of various hays appeared to decrease with the application of fertilizers, and especially was this true with legumes. The protein content of alsike clover increased, that of timothy and mixed hay decreased, while that of alfalfa appeared unchanged with variations in the application of phosphate fertilizers. In general no direct relationship was shown in the fluctuations of nitrogen and phosphorus in the samples studied.

A microscopic study of beef tissues, F. J. BEARD (*Okla. Acad. Sci. Proc. [Okla. Univ.]*, 7 (1927), pp. 40-42).—This is a rather brief report of the results of microscopic studies of muscle tissues from different parts of the carcasses of a 1.5-year-old heifer, a short fed steer of about the same age, a 2-year-old steer fed grain from birth, an aged cow, and a 3-months-old calf. The muscles studied were the adductor, biceps femoris, psoas major, longissimus dorsi, triceps brachii, and the common digital extensor. A comparison of the size of the muscle fibers and of the disposition of fat between the fibers is made of the individuals.

Beef slaughtering, cutting, and curing, H. H. SMITH (*Utah Sta. Circ.* 81 (1929), pp. 16, figs. 11).—A popular publication discussing the slaughtering, cutting, and curing of beef on the farm.

Lamb slaughtering and cutting, H. H. SMITH (*Utah Sta. Circ.* 82 (1929), pp. 16, figs. 25).—The slaughtering and cutting of lamb on the farm are discussed in this popular publication.

Aids to selection of rams, N. A. BOWMAN (*Victoria Dept. Agr. Bul. 59* (1929), pp. 30, figs. 14).—This is a description of the characteristics of the more common Australian and British breeds of sheep.

Variations in the skeletal structure of the pig, A. M. SHAW (*Sci. Agr., 10* (1929), No. 1, pp. 23-27).—Variations in the number of pairs of ribs in hogs based on 3,957 animals representing several breeds, grades, and crosses, are presented in this paper from the University of Saskatchewan, Canada. The data were obtained in Canada, the United States, England, and Denmark.

The number of pairs of ribs varied from 13 to 17, and variations were found in all breeds. Although litter mates showed a greater uniformity than unrelated animals, no one case of complete uniformity was found in litters of normal size. The larger breeds, and particularly the types possessing heavy bone, were definitely associated with the additional ribs, while the small or medium sized breeds and types recognized as fine bone were associated with the lesser number of ribs. Examination of the vertebral column showed that the number of cervical vertebrae were constant, that the thoracic vertebrae varied according to the number of ribs present, and that the usual variation of lumbar vertebrae was from 6 to 7, only 2 animals being found with 5. The true ribs were always attached to the thoracic vertebrae. No correlation was found between sex and the number of ribs.

Mule feeding experiments, G. S. TEMPLETON (*Mississippi Sta. Bul. 270* (1929), pp. 38, figs. 9).—In part 1 of this bulletin the results of a test to determine the value of self-feeders for work mules are presented. Ten pairs of mules were so divided that team mates were placed in different lots. Lot 1 was self-fed a mixture of 2 parts of ground shelled corn (later changed to shelled corn) and 1 part of ground alfalfa hay, with additional alfalfa in a rack. Lot 2 was lot-fed shelled corn in a trough with hay in a rack. The mules were used in the regular farm work.

The use of self-feeders made it possible to fatten and to carry in high condition mules doing heavy work. The use of self-feeders eliminated waste, gave each mule an equal opportunity to share in the feed, required less time to feed, and fitted nicely into the feeding system. Mules on a self-feeder consumed from 13.4 to 13.7 lbs. of shelled corn per 1,000 lbs. of live weight. Fewer cases of digestive disorders occurred among the mules on the self-feeder than among those that were lot-fed. There was no noticeable difference in the gains in weight or the ability of the mules to stand heat in the 2 lots.

Part 2 gives the results of a study to determine the effect of grinding shelled corn and ear corn on mules doing heavy work. Six teams were used in the shelled corn and five teams in the ear corn study. They were divided into four lots by placing team mates in lots 1 and 2 and in lots 3 and 4. Johnson grass hay at the rate of 12 lbs. per head daily was fed to all lots throughout the test, and in addition the respective lots received shelled corn, shelled corn ground, ear corn, and ear corn ground. This system of feeding continued for 150 days, when the lots receiving the whole feed were changed to ground feed and vice versa. After 150 days the lots were returned to their original ration for a third period of 150 days. Each animal in lot 1 received 12 lbs. of shelled corn, lot 2 10.8 lbs. of ground shelled corn, lot 3 about 14.2 lbs. of ear corn, and lot 4 about 12.8 lbs. of ground ear corn.

The difference in the amount of work done by the mules in lots 1 and 2 and in lots 3 and 4 was insignificant. Grinding effected a saving of about 10 per cent in grain, both in the case of shelled corn and ear corn. All of the rations were on the average satisfactory for maintaining the live weight of the mules during the three periods. A few cases of colic developed in the various lots during the test, but all of the cases were of a mild form.

For the experiments reported in the other sections of this publication more detailed accounts have been previously noted (E. S. R., 62, pp. 66, 163).

Cane molasses for poultry, A. R. WINTER (*Poultry Sci.*, 8 (1929), No. 6, pp. 369-373).—Cane molasses was used in amounts up to 15 per cent of the ration for laying hens, and up to 10 per cent for growing chicks. The birds receiving the molasses made slightly better gains and consumed somewhat more feed than birds not receiving molasses. The hatchability of the eggs from the birds receiving molasses was a little better than that of eggs from birds not receiving this feed. One trial in which molasses was fed at the rate of 15 per cent showed that it was of no value in preventing coccidiosis, and that it had no effect on the pH of the intestinal contents.

The results indicate that cane molasses may be used to replace grains, pound for pound, up to 10 per cent of the ration for growing chicks and laying hens. At this rate it is a mild laxative, causes increased water consumption, and contributes toward the health and condition of birds, but in larger amounts it creates thirst and causes the birds to drink too much water.

Use of proteins from different sources in feeding baby chicks, G. S. FRAPS and D. H. RED (*Poultry Sci.*, 8 (1929), No. 6, pp. 383-386).—In an effort to determine the value of proteins from different sources for feeding baby chicks, the Texas Experiment Station fed 6 different rations as starter feeds for periods of 5 weeks. A ration known to produce normal growth in chicks, and containing 15 per cent of shorts and 15 per cent of dried buttermilk, was selected as a standard. In the second ration, 14 per cent of shorts was substituted for 5 per cent of buttermilk; in ration 3, 7 per cent of meat scrap for 10 per cent of buttermilk; in ration 4, 5 per cent of cottonseed meal for 5 per cent of buttermilk; in ration 5, 14 per cent of shorts and 4 per cent of meat scrap for 10 per cent of buttermilk; and in ration 6, 8 per cent of cottonseed meal for 10 per cent of buttermilk.

Ration 4 gave the best results, while rations 2 and 6, and especially 2, were inferior, due in part to their bulky nature. The results indicate that meat scrap, cottonseed meal, or wheat shorts and meat scrap can replace part of the dried buttermilk without reducing the feeding value of the ration and at the same time reduce the cost of the mixture.

The effect of feeding rachitic diets, containing different ratios of calcium to phosphorus, on the calcium and inorganic phosphorus of the blood serum of chicks, O. N. MASSENGALE (*Poultry Sci.*, 8 (1929), No. 6, pp. 335-343).—In this study at the New Jersey Experiment Stations a lot of 150 newly hatched White Leghorn chicks were placed on a complete ration for a period of 10 days and were so housed that they received no direct sunlight. At the end of this period 8 chicks were killed and blood samples were taken for analyses for calcium and inorganic phosphorus. From the remaining birds 4 lots of 30 strong, vigorous, healthy chicks were selected and placed on a basal ration of yellow corn meal, standard wheat middlings, and salt 79 : 20 : 1. This ration was supplemented as follows: Lot 1, no supplement; lot 2, 2 per cent of potassium phosphate; lot 3, 2 per cent of calcium carbonate; and lot 4, 2 per cent of tricalcium phosphate. Liquid semisolid buttermilk was fed to all lots. At the end of 2, 3, and 4 weeks of such feeding 5 birds from each lot were killed and blood samples taken for analyses. At the end of the fourth week the remaining birds in each lot were divided into two groups, and one group fed 1 per cent of cod-liver oil. After 1 week all of the birds were killed and the blood analyzed.

Leg weakness of chicks appeared earlier when a rachitic diet low in calcium but high in phosphorus was fed than when a similar ration low in phosphorus and high in calcium was fed. The blood serum of chicks on the ration in

which calcium was higher than phosphorus was higher in calcium than inorganic phosphorus, while when the ratio of calcium to phosphorus in the ration was reversed the inorganic phosphorus of the blood serum was higher than the calcium. Cod-liver oil added to the rachitic diet of chicks suffering from leg weakness tended to increase the calcium content of the blood serum, regardless of the calcium-phosphorus ratio of the ration. On the other hand, cod-liver oil added to rachitic diets in which the content of phosphorus was approximately three times that of calcium tended to lower the inorganic phosphorus content of the blood serum, but when the calcium-phosphorus ratio was reversed cod-liver oil tended to increase the inorganic phosphorus content of the blood serum.

Early growth of White Leghorns, W. A. HENDRICKS, A. R. LEE, and H. W. TITUS (*Poultry Sci.*, 8 (1929), No. 6, pp. 315-327, figs. 2).—The results of a study of the growth for the first 14 to 15 weeks of age of 9 lots of White Leghorn chicks hatched at different seasons of the year are reported in this paper from the U. S. D. A. Bureau of Animal Industry. While the rations used in the different lots were not the same, they were comparable in that they enabled the chicks to make satisfactory growth. The estimate of average growth was made by fitting the equation of the curve which describes the course of an autocatalyzed, monomolecular, chemical reaction to the data. The root-mean-square deviation, the coefficient of deviation, the average positive and negative deviations, and the average positive and negative percentage deviations from the calculated average live weights are presented in tabular form.

Brooding and feeding chicks, (H. A. BITTENBENDER, R. L. WATKINS, W. M. VERNON, and W. R. WHITFIELD (*Iowa Agr. Col. Ext. Bul.* 148 (1928), pp. 20, figs. 11).—A practical publication discussing the equipment and methods of management, especially brooding and feeding, for raising chicks.

Brooding and pullet management, W. E. NEWLON and M. W. BUSTER (*Calif. Agr. Col. Ext. Circ.* 28 (1929), pp. 34, figs. 2).—This is a practical treatise dealing with the various phases of brooding, feeding, and management of pullets.

Studies in hatchability.—III, **Hatchability in relation to coefficients of inbreeding**, M. A. JULL (*Poultry Sci.*, 8 (1929), No. 6, pp. 361-368).—Continuing these studies (*El. S. R.*, 61, p. 864) by the U. S. D. A. Bureau of Animal Industry, the results obtained from 4 pens each of Barred Plymouth Rocks and White Leghorns that had been inbred continuously for 3 years after the original 8 pens of females had been mated to unrelated males are reported. The inbreeding practice followed consisted of selecting 5 full sisters and a full brother and 2 trios of half sisters from the progeny of each pen to constitute a breeding pen for continuing the work.

The results show that the hatchability of the eggs decreases as the coefficients of inbreeding increases. In general the greatest relative decrease in hatchability occurred between a coefficient of inbreeding of 0 and 12.5. As the coefficient of inbreeding increased, the decrease in hatchability was greater for the Plymouth Rocks than for the White Leghorns in this study. Significant differences in hatchability were not obtained with the same coefficients of inbreeding, regardless of the year in which the breeding work was done. Continuous full-brother-and-sister matings affected hatchability adversely to a greater extent than full-brother-and-sister matings followed by half-brother-and-sister matings.

Vitamin E requirements of poultry, L. E. CARD (*Poultry Sci.*, 8 (1929), No. 6, pp. 328-334).—To determine whether the addition of vitamin E to an ordinary ration would improve the fertility or hatching power of hens' eggs,

two lots of 20 White Leghorn hens each, grouped on the basis of first years' egg production, were fed from December to May at the Illinois Experiment Station. The same basal ration, consisting of ground yellow corn, wheat bran, wheat flour middlings, meat scrap, and salt 60 : 15 : 15 : 9 : 1, was fed to both lots. In addition lot 2 received 2 per cent of wheat germ oil. Full-brother males were mated with the hens and were alternated between the lots every 3 days. Eggs were set weekly from February 29 to April 18.

Although lot 2 started to lay about 4 weeks earlier than lot 1, only 437 eggs were set from lot 2 as compared with 505 eggs from lot 1. The average percentage hatch in lot 1 was 56.56 ± 3.11 and in lot 2, 31.49 ± 4.15 . The average percentage of fertile eggs hatched was 58.83 ± 3.13 in lot 1 and 33.44 ± 4.18 in lot 2. Practically all of the infertile eggs in each lot were laid by a very few hens. These results indicate that the addition of 2 per cent of wheat germ oil to a mixed grain ration will not improve the fertility or hatching power of hens' eggs.

In a laboratory test by H. P. Morris and H. H. Mitchell, two lots of 6-weeks-old chicks were fed a synthetic diet very low in vitamin E. One lot received in addition 2 per cent of wheat germ oil. The seven pullets receiving wheat germ oil laid 28 eggs during August, all of which proved fertile. Only two pullets survived on the basal diet and began laying at about 9 months of age. One bird produced five fertile eggs, while none of the other bird's eggs were fertile. When the ration of this latter hen was changed to include 2 per cent of wheat germ oil, she laid 19 eggs, 8 of which were fertile and 4 of which hatched. When all surviving hens were placed on the basal ration no fertile eggs were laid.

Effect of certain green feed substitutes upon egg production and hatchability. H. O. STUART (*Poultry Sci.*, 8 (1929), No. 6, pp. 354-360).—In this study 6 lots of 10 pullets each were fed from November 1 to May 1. All lots received a basal mash mixture of 50 lbs. of white corn meal and 20 lbs. of meat scrap, and to this was added in lot 1 30 lbs. of wheat bran, in lot 2 20 lbs. of bran and 10 lbs. of ground oats, in lot 3 15 lbs. of alfalfa leaves, 10 lbs. of ground oats, and 5 lbs. of bran, in lot 4 15 lbs. of alfalfa leaf meal, 10 lbs. of ground oats, and 5 lbs. of bran, and in lots 5 and 6 20 lbs. of bran and 10 lbs. of ground oats. All lots received whole white corn as scratch except lot 5, which received yellow corn. Lot 1 received sprouted oats, lot 2 yellow mangel beets, and lot 6 1 per cent of cod-liver oil in addition to the above feeds.

The average egg production was highest in the cod-liver oil pen, with the sprouted oats pen second, and the alfalfa leaf pen third. The production in the other pens was practically the same. The average percentage hatchability showed the pens to rank in the following order: 4, 3, 5, 1, 2, and 6, respectively. These results indicate that cod-liver oil excelled for egg production, but alfalfa leaf meal and alfalfa leaves gave the highest hatchability. When 15 per cent of the alfalfa products was fed, the palatability of the mash was decreased but the leaves were more palatable than the meal. All of the substitutes were good sources of vitamin A, only one bird dying of avitaminosis A during the course of the experiment.

Improving market poultry by producers and poultry dealers (*U. S. Egg and Poultry Mag.*, 35 (1929), No. 7, Sect. 2, pp. 16, figs. 30).—By means of illustrations, this publication suggests methods for improving the quality and appearances of market poultry.

Cost of growing and managing turkeys. O. A. BARRON (*Poultry Sci.*, 8 (1929), No. 6, pp. 347-352).—Data on the cost of growing and wintering turkeys, together with additional information in regard to disease control and dressing turkeys, are presented in this paper from the North Dakota Experiment Station.

Raising turkeys in Wisconsin, J. B. HAYES and G. E. ANNIN (*Wis. Agr. Col. Ext. Circ. 231* (1929), pp. 16, figs. 6).—Methods of breeding, feeding, management, and the sanitary precautions that have been found successful for raising turkeys in Wisconsin are discussed in this publication.

DAIRY FARMING—DAIRYING

Further studies of the rôle of vitamin C in the nutrition of calves, L. M. THURSTON, L. S. PALMER, and C. H. ECKLES (*Jour. Dairy Sci.*, 12 (1929), No. 5, pp. 394-404, figs. 4).—In studies at the Minnesota Experiment Station (E. S. R., 55, p. 871), four calves grew at a normal rate or better for a period of one year on a ration which produced scurvy in guinea pigs in from 20 to 30 days. Water extracts of the livers of these calves fed to guinea pigs revealed that this organ contained a considerable quantity of the antiscorbutic vitamin. A heifer fed from birth on a scorbutic ration secreted milk which contained an appreciable quantity of vitamin C, as shown in tests with guinea pigs. The absence of vitamin C from the diet apparently had no effect upon the reproductive function of the animals.

The results obtained indicate that vitamin C is synthesized in the animal body, but how and where this synthesis takes place was not determined. Tests with guinea pigs of the antiscorbutic value of the feces and stomach content of calves on scorbutic rations were negative, and while sufficient data were not available to draw conclusions those obtained indicated that the synthesis did not occur in the digestive tract.

The New Jersey dry-fed calf mixture, C. B. BENDER and E. J. PERRY (*N. J. Agr. Col. Ext. Bul. 73* (1929), pp. 4, figs. 2).—A method of feeding calves that permits farmers to sell whole milk and raise their own replacement animals with a minimum of labor and expense, and at the same time reduce the amount of digestive disturbances among young animals, is discussed in this publication. See also a previous note (E. S. R., 61, p. 561).

Rearing dairy heifers free from tuberculosis and abortion disease, C. M. HARING (*Calif. Agr. Col. Ext. Circ. 33* (1929), pp. 19, figs. 6).—Practical suggestions are presented in this publication for raising healthy heifer calves.

Effect of cottonseed meal and linseed oil meal on the consistency of feces of dairy cattle, C. F. HUFFMAN and L. A. MOORE (*Jour. Dairy Sci.*, 12 (1929), No. 5, pp. 410-418, fig. 1).—The consistency of the feces of 3 Holstein heifers fed cottonseed meal from 90 days to about 2 years of age and of 3 Holstein heifers fed linseed oil meal for the same period was determined at the Michigan Experiment Station by using a wooden ball with graduations and measuring the depth to which the ball sank into different feces when a 500-gm. weight was placed on it. Differences in consistency were determined when cottonseed meal and linseed oil meal were fed with timothy hay and corn silage, with timothy hay and without corn silage, and at the rate of 2 lbs. per head daily with timothy hay as a roughage.

The results indicate that cottonseed meal is not a costive feed for dairy cattle. Rapid changing from heavy cottonseed meal feeding to heavy linseed oil meal feeding did not alter the consistency of the feces, nor was there any appreciable difference between the effects of feeding a large and a small amount of cottonseed meal.

The Pennsylvania Association of Dairy and Milk Inspectors fourth [and fifth annual reports, 1928 and 1929], compiled by G. C. MORRIS (*Penn. Assoc. Dairy and Milk Insp. Ann. Rpts.*, 4 (1928), pp. 1-211, pls. 4, figs. 17; 5 (1929), pp. 1-224, pls. 11, figs. 6).—These reports of the association meetings (E. S. R., 57, p. 667) contain the following papers:

1928.—Presidential Address: Suggestions for the Future, by J. W. Rice (pp. 29-35); Keeping Milk Within Legal Limits, by J. W. Kellogg (pp. 36-40); A General Survey of Pennsylvania Bovine Tuberculosis Eradication Work, by S. E. Bruner (pp. 41-50); The Milk Inspector as an Educator, by I. V. Hiscock (pp. 51-58); Recording Thermometers, by R. E. Irwin (pp. 59-73); Report of the Committee on Communicable Diseases Transmitted Through Milk, by J. F. Shigley et al. (pp. 74-78); A Study of the Electropure Process in the Treatment of Milk, by S. R. Haythorn and R. E. Erwin (pp. 79-86); How the Quality of Milk for Pasteurization Is Improved by the Payment of a Bonus Based on the Sediment Test and Methylene Blue Test, by H. M. Browning (pp. 87-94); A Short Course for Milk Inspectors, by W. J. Lewis (pp. 95-98); Dairy Stable Ventilation as a Factor in the Construction and Remodeling of Dairy Barns, by W. A. Snyder (pp. 99-103); The Production of Raw Milk for Sale Direct to the Consumer, by J. B. Smith (pp. 104-106); Sanitary Requirements in Ice Cream Production, by F. Rasmussen (pp. 107-117); Field Work During 1927. Division of Milk Control, Pennsylvania Department of Health, by H. E. Shroat (pp. 118-123); How to Replace Raw Milk with Pasteurized Milk, by W. J. Engle (pp. 124-128); The Dairy Council—a Service Organization, by R. W. Balderston (pp. 129-132); Pasteurization of Milk, by G. W. Grim (pp. 133-145); The Milk Control Program of New York State, by P. B. Brooks (pp. 146-149); Use of Direct Microscopic Count in Quality Control, by C. G. Gifford (pp. 150-159); Milk Plant Design and Equipment, by G. E. Matter (pp. 160-173); Report of Committee on Pasteurization, by R. E. Irwin et al. (pp. 174-178); Report of Committee on Legislation, by G. W. Grim et al. (pp. 179-185); and Report of Special Committee on Milk Regulations of the Pennsylvania Association of Dairy and Milk Inspectors, by J. W. Rice et al. (pp. 186-207).

1929.—Presidential Address, by W. F. Davison (pp. 25-27); Regulating the Sale of Foods, by J. W. Kellogg (pp. 28-35); A General Survey of Pennsylvania's Bovine Tuberculosis Eradication Work, by S. E. Bruner (pp. 36-38); Undulant Fever, by H. B. Wood (pp. 39, 40); Bang Disease Control in Pennsylvania, by H. R. Church (pp. 41-48); Arrangement and Remodeling of Dairy Barns, by N. S. Grubbs (pp. 49-55); Dairy Barn Ventilation, by P. E. Griffith (pp. 56-64); The Production of Raw Milk for Sale Direct to the Consumer, by C. A. Kern (pp. 65-68); The Producer's Viewpoint of Farm Inspection, by W. W. White (pp. 69-73); Report of the Committee on Communicable Diseases Transmitted Through Milk, by J. F. Shigley (pp. 74-76); Establishing a Quality Milk Business in a Small Community, by L. E. Bechtel (pp. 77-80); Construction of Dairy Plant Equipment from a Sanitary Standpoint, by D. C. Lightner (pp. 81-90); Milk Plant Ventilation, by F. Gallaher (pp. 91-96); Milk Waste Disposal, by W. L. Stevenson (pp. 97-99); Report of the Committee on Methods for the Bacterial Analyses of Milk and Milk Products, by J. W. Rice (pp. 100-116); Practical Milk Control in Schuylkill County, by M. P. Sponis (pp. 117-120); Clean and Safe Milk for Small Communities, by H. R. Estes (pp. 121-128); Heat-Resistant and Heat-Loving Bacteria in Pasteurized Milk, by R. S. Breed (pp. 129-143); Report of the Committee on Hygiene and Dairy Methods, by C. G. Gifford (pp. 144-146); Cooperation Between States Regarding Conditions Surrounding the Production of Milk for Interstate shipment, by W. W. Scofield (pp. 147-150); Improving the Quality of Milk Through Payment of Bonuses, by C. I. Cohee (pp. 151-158); Filtering Milk on the Farm, by M. E. Schwartz (pp. 159-169); Report of the Committee on Pasteurization, by R. E. Irwin (pp. 170-183); Preparation and Marketing of Cottage Cheese, by C. S. Detwiler (pp. 184-188); Eighteen Months of Lancaster's Milk Ordinance, by H. B. Mitchell (pp. 189-192); Recent Conventions of Interest to Milk Inspectors, by G. W. Grim (pp. 193-200); My

Story of the Evolution of Milk Control in Scranton, by F. J. Widmayer (pp. 201-207); and Recording Thermometers, by R. E. Irwin (pp. 208-219).

An unappreciated but important factor in the pasteurization of milk, J. M. SHEERMAN and C. N. and P. STARK (*Jour. Dairy Sci.*, 12 (1929), No. 5, pp. 385-395).—Studies at the New York Cornell Experiment Station showed that the age of the bacterial cells influences greatly the susceptibility of the organisms to heat. Young cells were more easily killed than older cells. However, milk samples held for 24 hours at 60°F. showed a greater percentage destruction of bacteria than similar samples pasteurized when fresh or when held at 40° for 24 hours.

Some of the points of practical significance in connection with pasteurization are discussed.

The solubility of calcium phosphate in fresh milk, E. O. WHITTIER (*Jour. Dairy Sci.*, 12 (1929), No. 5, pp. 405-409).—In this article from the Bureau of Dairy Industry, U. S. D. A., the author has calculated the calcium-ion concentration of normal fresh milk based on the mutual effects of hydrogen, calcium, phosphate, and citrate ions on one another. A calculation of the ion product $[Ca^{++}] \times [HPO_4^{--}]$ in normal fresh milk gave a value less than that of the corresponding solubility product. To prove the soundness of the method of calculation, data are presented in which the precipitation of calcium phosphate was prevented by the presence of citrate. The results led to the conclusion that the solubility of calcium phosphate in milk is affected by the amount of citrates present, and that the effect is probably specific.

Copper in dairy products and its solution under various conditions, II, J. MISCALL, G. W. CAVANAUGH, and P. P. CARODEMOS (*Jour. Dairy Sci.*, 12 (1929), No. 5, pp. 379-384, fig. 1).—Continuing this study at the New York Cornell Experiment Station (E. S. R., 50, p. 178), the results show that the copper-dissolving property of milk increases directly up to 140 to 145° F. and then decreases. This property of milk is decreased either by the removal of the milk gases or by the addition of carbon dioxide. The presence of oxygen increases the amount of copper which goes into solution, but does not change the general type of the solubility curve. Pasteurized milk dissolves more copper than raw milk at the same temperature. It is concluded that when milk is heated for two hours in contact with bright copper, above the temperature of pasteurization, some reaction takes place in the milk serum which decreases the copper-dissolving property of the milk.

The relative values of high- and low-testing milk for cheesemaking in New Zealand, P. O. VEALE (*New Zeal. Dept. Sci. and Indus. Research Bul.* 9 (1929), pp. 74, pls. 10).—This is a statistical study of the percentages of fat, casein, total solids, and solids-not-fat of the milk of the Holstein-Friesian, Ayrshire, and Jersey breeds, the gross yields of cheese per pound of butterfat obtainable from such milks, the losses of fat, casein, and total solids occurring in the whey from these milks, the percentages of moisture, fat, and proteins occurring in different varieties of cheese, and the shrinkage of different types of cheese during curing and in shipping to England. The composition of cheese best suited to export trade, the effect of fat and moisture content upon the suitability of the cheese, and some economic factors in relation to the cheese industry in New Zealand are also discussed.

The yield of cheese per pound of butterfat, P. O. VEALE (*New Zeal. Dept. Sci. and Indus. Research Bul.* 13 (1929), pp. 23).—A discussion of the factors and the attendant circumstances influencing them which affect the yield of cheese per pound of butterfat.

A color defect of process cheese, W. V. PRICE (*Jour. Dairy Sci.*, 12 (1929), No. 5, pp. 375, 378).—In this article from the New York Cornell Experiment

Station, the author describes how an undesirable dark color of a process cheese was detected and overcome. Laboratory tests showed that the incorporation of sufficient quantities of dried and discolored cheese which accumulated on the unwashed kettles from previous batches was responsible for the discoloration.

VETERINARY MEDICINE

[Report of the department of veterinary science of the Western Washington Station] (*Western Washington Sta. Bul. 14-W* (1929), pp. 37-48, figs. 2).—This is a report of the occurrence of and work with some of the more important diseases of the fowl and of cattle.

In further work with fowl pox (E. S. R., 60, p. 775; 61, p. 572) by C. E. Sawyer and C. M. Hamilton, it was considered inadvisable to recommend the use of the active virus during the summer of 1929 because (1) of the high mortality in a few flocks that followed the vaccination in 1928 and (2) of the natural pox infection that occurred in slightly more than 1 per cent of the 55,000 birds in the field trials of 1928, as a result, it is thought, of inactive or dead virus in the vaccine. At the request of flock owners, however, a virus-vaccine was used on 45 poultry farms with a total of over 45,000 birds largely from 3 to 4 months of age. In this work a pulverized fowl-pox scab which had been removed from the comb of a cockerel not longer than 6 weeks previous to vaccination was mixed with water at the time of use and applied by dipping a sharp pointed knife in a small amount of it and then piercing the featherless portion of the skin on the thigh. The reports received indicate that this virus vaccination is not responsible for many deaths during the 5 weeks that follow.

The same authors report upon work with infectious bronchitis of the fowl, which occurred in various parts of the State, first appearing in a commercial poultry feeding station in Seattle. Heavy losses have resulted from its outbreak in chicks from 1 to 2 months of age. The infectious nature of the disease was demonstrated both in natural outbreaks and in experimental inoculations at the station. The causal agent, which has not been identified, was removed from the filtrate when filtered through earthen filters and was apparently destroyed by heating at 60° C. for 1 hour, by drying at 104° F. for 48 hours, and by prolonged storage at room temperature or in the ice box. The disease was observed more frequently at the station in pullets between 6 and 12 months of age when in heavy egg production, although reports show that birds between the ages of 3 weeks and 3 or 4 years have been affected. The symptoms of the acute and chronic forms are given, together with the post-mortem findings of birds dead from the disease.

A brief account of coccidiosis is given by Sawyer.

Studies of bacillary white diarrhea are reported upon by Sawyer and Hamilton. In a comparison of plate and tube tests it was found that occasionally a blood sample would show complete reaction to one and very little to the other, but that in a high percentage of tests there was complete agreement in the results of the two methods. In the fall of 1927 two groups of White Leghorn hens that were positive reactors to pullorum disease on the routine agglutination test were purchased for experimental work. The first group contained 47 hens, the majority of which were kept for a year and killed and examined at the end of that time. None of the hens died until three blood tests at intervals of 1 month had been made, the majority having been tested nine times during the year. Forty-six of the 47 birds were positive to either the plate or tube method or to both in every test conducted, the blood of the forty-seventh failing to give a positive reaction on the last two tests. Upon post-mortem examination *Salmonella pullorum* was isolated from the ovary of 80 per cent of these hens,

including the one which was negative on the last two blood tests. Visibly affected yolks were demonstrated in 85 per cent of the hens in this group. In the second group of 14 hens purchased at another farm 6 died before the year was ended, but 2 or more blood tests had been made prior to their death. The other hens were tested eight times during the year by both the tube and plate methods in practically all of the tests. Eleven hens gave a positive reaction on all tests, 2 were negative on one test, and 1 was negative on two tests. All of the 14 birds in the group were autopsied and *S. pullorum* was isolated from the ovary in 85 per cent, and 85 per cent had visibly affected yolks.

In further work conducted by Sawyer and Hamilton with the microscopic chicken tapeworm *Davainea proglottina* (E. S. R., 60, p. 775), chicks ranging in age from 2.5 months to mature birds were parasitized through the artificial feeding of garden slugs that harbored the cysticercoids. Post-mortem examination of the birds showed, however, that this method of feeding did not consistently cause the birds to become infested, since one bird was found to harbor 349 adult tapeworms and other birds that were fed the same number of slugs on the same day were negative. Three cockerels fed infested slugs and examined 24 days later were found to contain 46, 60, and 45 tapeworms, respectively. Five hens similarly infested were found to harbor the tapeworms.

A brief reference is made by J. W. Kalkus and Sawyer to the eradication work at the station with infectious abortion through segregation of positive and negative reacting cows (E. S. R., 60, p. 775). In addition to the cows that were in the herd at the time of the first test 49 negative cows and heifers have been added from time to time, and every animal with one exception has remained negative. Reference is made to the intravenous injection of acriflavine in seven cows in the positive herd in the fall of 1927.

A brief reference is made to the progress of the work with red water in cattle (cystic hematuria), by Kalkus and Sawyer (E. S. R., 60, p. 775). In feeding experiments oxalic acid failed to cause red water.

Veterinary research report, 1927-28, No. 5 (N. S. Wales Dept. Agr., Vet. Research Rpt., 5 (1927-28), pp. 124, pls. 12).—The papers presented in this report are as follows: Annual Report of the Director of Veterinary Research for the Year 1927-28 (pp. 3-9) and Mycotic Dermatitis of Sheep (pp. 10-17), both by H. R. Seddon; On the Occurrence of Black Disease Bacilli in the Livers of Normal Sheep (pp. 18-26) and An Inquiry into the Etiology of Blackleg in Calves [due to *Clostridium chauvei*] in New South Wales (pp. 27-35), both by G. Edgar; Infectious Labial Dermatitis or "Scabby Mouth" in Sheep and Goats, by H. R. Seddon and H. G. Belschner (pp. 36-44); Observations on Rabbit Myxoma, by H. C. White (pp. 45-47); Locomotory Disturbances of Pigs, by H. R. Seddon and W. A. C. Fraser (pp. 48-61); Observations on the Treatment of Parasitic Gastro-enteritis in Sheep, by H. R. Seddon and I. C. Ross (pp. 62-85); *Euphorbia drummondii* ("Milk Weed") Proved Poisonous to Sheep, by H. R. Seddon (pp. 86-90); Feeding Experiments with *Euphorbia eremophila*, by H. R. Seddon and W. L. Hindmarsh (pp. 91-93); Feeding Tests with *Lantana camara* (Common Pink-Flowered Lantana), by H. R. Seddon, H. R. Carne, and T. T. McGrath (pp. 94, 95); *Acacia glaucescens* ("River Myall" or "Sally Wattle") Proved Poisonous to Stock, by H. R. Seddon and H. C. White (pp. 96-99); Feeding Test with *Portulaca oleracea* "Pig Weed" or "Purslane," by H. R. Seddon (p. 100); Lambs' Tails (*Boussingaultia baselloides*): A Reputed Poisonous Climber, by H. R. Seddon and W. L. Hindmarsh (pp. 101, 102); The Effect of Young, Immature St. John's Wort (*Hypericum perforatum*) on Sheep, by H. R. Seddon and H. G. Belschner (pp. 103-105); Some Observations on the Toxic Principle of St. John's Wort (*Hypericum perforatum*), by H. R. Seddon and H. C.

White (pp. 106-111); An Investigation into the Feeding Value of Wholemeal and White Bread to Animals, by H. R. Seddon and W. A. C. Fraser (pp. 112-123); and A Case of Pulmonary Streptothricosis in a Bovine, by W. L. Hindmarsh (p. 124).

[Diseases of livestock in Northern Rhodesia], D. O. TURNBULL (*North Rhodesia Vet. Dept. Ann. Rpt. 1928*, pp. 11-19).—Work with the more important livestock diseases of the year is reported upon.

Diseases common to man and animals, R. RANDALL (*Mil. Surg.*, 64 (1929), No. 6, pp. 882-893; also in *Hosp. Corps Quart. [U. S. Navy]*, 13 (1929), No. 3-4, pp. 207-218).—This is a brief practical summary of information.

Serologic specificity of streptococci having elective localizing power as isolated in various diseases of man, E. C. ROSENOW (*Jour. Infect. Diseases*, 45 (1929), No. 5, pp. 331-359, fig. 1).—It is pointed out that from a long continued study on focal infection and elective localization much evidence has been brought forward indicating that streptococci of the *viridans* group are of etiologic significance in a considerable number of acute and chronic diseases. The microorganisms which have possessed this elective or specific localizing power were nearly always streptococci belonging to the *viridans* group.

The author reports upon the methods used in the preparation of the various antisera and on the results obtained from their use over a period of 12 years in differentiating the isolated streptococci which appear to be of etiologic significance in the different diseases studied. The results from the serologic study support those obtained from studies of elective localization, and the conclusion that the various strains isolated in a study of the different diseases are of etiologic importance is considered warranted.

The pathogenicity of the species of the genus *Brucella* for monkeys, I. F. HUDDLESON and E. T. HALLMAN (*Jour. Infect. Diseases*, 45 (1929), No. 4, pp. 293-303).—Work at the Michigan Experiment Station indicates quite clearly that *B. abortus* (Bang) is pathogenic for the monkey, in which it produces a disease resembling undulant fever. The infection, however, is not readily produced, and in many cases does not occur at all. Monkeys are readily susceptible to infection from a small dose of the porcine form (*B. suis*) regardless of its source, the data indicating that it is more virulent for the monkey than is *B. melitensis*.

The skin as a portal of entry in *Br. melitensis* infections, A. V. HARDY, M. G. HUDSON, and C. F. JORDAN (*Jour. Infect. Diseases*, 45 (1929), No. 4, pp. 271-282).—The authors' experiments show that the normal skin of guinea pigs is more vulnerable as a portal of entry than is the digestive tract, and the epidemiological evidence indicates that the same is true of humans. Since the organisms gain entrance without causing any local lesions, the probable portal can be determined only by considering carefully the types of exposure, the dosage, and the resistance to invasion at the different portals. It is considered probable that *Brucella melitensis* frequently gains entrance through the skin to produce undulant fever in man.

The diagnosis of *Brucella abortus* infection in the udder of the cow, J. P. TORREY (*Amer. Jour. Pub. Health*, 19 (1929), No. 12, pp. 1360, 1361).—This is a contribution from the Michigan Experiment Station in which the author is led to conclude that the agglutination test is approximately 98 per cent perfect and may be employed to advantage by city inspectors and city health authorities. It is said that the experimental data on which this discussion is based will be published in the near future.

Vaccination with living cultures against infectious abortion of cattle [trans. title], O. BANG (In *Festschr. Eugen. Fröhner zu seinem 70. Geburtstage. Stuttgart: Ferdinand Enke, 1928*, pp. 1-10; abs. in *Cornell Vet.*, 19 (1929), No.

4, pp. 421, 422).—The use of living cultures in the vaccination of 784 heifers in infected herds is reported upon, abortions having resulted in 15.1 per cent. In the same herds 181 heifers were vaccinated with killed cultures, 54.1 per cent aborting. This is considered to indicate the value of vaccination with living cultures.

Metaphen in the treatment of puerperal septicemia and other blood stream infections. J. B. BERNSTINE (*Amer. Jour. Obstet. and Gynecol.*, 18 (1929), No. 2, pp. 220–229; *abs. in Cornell Vet.*, 19 (1929), No. 4, p. 422).—The author reports that in the past three years metaphen has been administered intravenously in a number of cases of bacteremia and septicemia with very satisfactory results. Its use in 16 cases is described. This chemical contains approximately 60 per cent of mercury and is so powerful that it inhibits the growth of staphylococci in a dilution as high as 1:20,000,000. Used against *Bacillus anthracis* it is said to be 11 times more powerful than bichloride of mercury.

Researches on Nemas and their larvae.—III, Strongyloides stercoralis Bavay. J. H. SCHUURMANS STEKHOFEN, JR. (*Ztschr. Wiss. Biol., Abt. F, Ztschr. Parasitenk.*, 1 (1928), No. 2, pp. 231–261, figs. 37).—The subject is dealt with under the headlines of history; the filariform larva; the free living female sex; the free living male sex; the progeny of the fertilized female; the larva of the indirect mode of development preceding the free living sexes; on autoinfection; on the determination of sex; longevity of the filariform larvae; and Rhabdiasoidea, Strongyloidea, and their relationship. A list of 45 references to the literature is included.

The various types of T. B. infection. L. VAN ES (*U. S. Egg and Poultry Mag.*, 35 (1929), No. 11, pp. 27–29, 66–68, fig. 1).—A brief summary of information on the several types of tubercle bacilli.

Culturing bovine tubercle bacilli. M. EVANOFF and H. C. SWEANY (*Amer. Rev. Tuberc.*, 20 (1929), No. 2, pp. 227–235, figs. 4).—The authors describe a direct method for obtaining culture growths and identifying tubercle bacilli from bovine material.

It was found that the bovine microorganisms isolated grow directly on cream-egg-milk medium but not on glycerin-egg-milk medium or other glycerinated media. There appears to be a shower of microorganisms associated in the lesions of cattle that resemble paratubercle bacilli, some of which appear to be tuberculogenic after animal passage. The authors recommend direct inoculation and treatment with 3 per cent hydrochloric acid and 3 per cent sodium hydroxide for best results.

A study of the intravenous tuberculin test as a means of diagnosing bovine tuberculosis. L. J. POELMA (*Cornell Vet.*, 19 (1929), No. 4, pp. 382–386).—This is a brief report on investigations conducted, together with a review of the literature.

The author found that 84.86 per cent of the 165 head of cattle reacting to the intradermal test also reacted to the intravenous test. Ten cc. of tuberculin at the same concentration used in the intradermal test appears to be the most suitable dose for mature cattle when given intravenously. Doses of 2, 4, and 6 cc. of intradermal tuberculin failed to produce diagnostic reactions in tubercular cows when given intravenously.

A case of bovine tubercle bacillus infection in man in India. M. B. SOPARKAR (*Indian Jour. Med. Research*, 17 (1929), No. 2, pp. 574–582, pl. 1).—The results of experiments on guinea pigs inoculated subcutaneously and on rabbits inoculated intravenously with tuberculous material of human origin, and on rabbits intravenously inoculated with a known bovine strain of high virulence, are reported in tabular form.

The prevention of human tuberculosis of bovine origin, W. G. SAVAGE (*London: Macmillan & Co., 1929, pp. VII+195, figs. 2; rev. in Cornell Vet., 19 (1929), No. 4, pp. 427, 428*).—The author considers that raw liquid milk can be accepted with reasonable certainty as the main vehicle for the transmission of bovine tubercle bacilli to human beings, that the tubercle bacillus of bovine origin is not responsible for more than 5 per cent of the total tuberculosis mortality, and that tubercular cervical glands in children are of bovine origin in over 50 per cent of cases.

The several chapters, all but the last of which include lists of references to the literature, deal with the subject as follows: The vehicles of spread (pp. 1-7), the amount of human tuberculosis of bovine origin (pp. 8-29), the problems of bovine tuberculosis (pp. 30-59), methods adopted for reducing bovine tuberculosis and the risks of tuberculous milk (pp. 60-115), technical problems in relation to bacteriological and veterinary control (pp. 116-136), immunity problems and bovine tuberculosis (pp. 137-157), pasteurization and tuberculous milk (pp. 158-177), and the reduction and elimination of human tuberculosis of bovine origin (pp. 178-191).

Tularemia from opossums, J. A. MEASE, JR. (*Jour. Amer. Med. Assoc., 92 (1929), No. 13, p. 1042*).—This is an account of a case of tularemia observed in Florida in a farmer who contracted the affection in the skinning of opossums.

Studies on anaplasmosis in cattle with special reference to (1) the susceptibility of calves born to recovered cows, and (2) the length of time recovered animals may remain carriers, W. H. BOYNTON (*Cornell Vet., 19 (1929), No. 4, pp. 387-395*).—In continuation of earlier work (E. S. R., 59, p. 79) and following a brief introduction, the author reports upon the susceptibility of calves born to recovered cows and the duration of infectivity of blood of recovered cattle. The three calves here described that were born to dams that had apparently recovered from anaplasmosis did not carry the causative agent in their blood. These three calves of recovered mothers were susceptible to anaplasmosis when inoculated with the blood from animals that carried the virus, two of them being susceptible to the same strain that their mothers carried. It was proved that although their intrauterine existence included the period during which their dams passed through a severe course of anaplasmosis, two of them did not contract the disease before they were born, did not carry the disease in their blood stream after birth, and were not immune to the disease when they were inoculated with blood from an animal that had recently recovered.

It was found that animals recovering from anaplasmosis in three different sections of California, and possibly representing three different strains, remained carriers of that disease, although they appeared to be normal. The lengths of time these animals were tested and proved to be carriers ranged from 5 months to 2 years 2 months 1 day.

On the nature of anaplasma, P. J. DU TOIT (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research, 13-14 (1928), pt. 1, pp. 155-184, pls. 3*).—This paper reports upon three series of experiments, the first being made with a view to observing the changes produced in the blood of cattle by the injection of trypan blue and other chemicals and to compare the changes so produced, if any, with the blood picture in true anaplasmosis; the second to determine whether in the smaller mammals, including dogs, rabbits, and guinea pigs, changes can be produced by the injection of blood poisons which can be compared with the blood picture observed in anaplasmosis of cattle; and the third to investigate the nature of anaplasma by means of experiments which will show whether the virus of anaplasmosis is contained in the red blood corpuscles,

whether it can be destroyed by hemolysis, and whether in hemolyzed blood it will pass through a bacterial filter.

It was found that the result of injecting large quantities of trypan blue into calves varies according to the previous history of the calves. In calves which had never had a blood infection practically no changes are produced, while in calves which had previously had an infection of *Anaplasma marginale* or *Gonderia mutans* the trypan blue will bring about a relapse with reappearance of these parasites in the blood. Trypan blue can not be regarded as a specific blood poison for cattle, for even in large quantities it produces practically no blood changes. It is pointed out that prolonged injections may, however, lead to a gradual intoxication with cachexia and death.

It was found that pyrogallie acid when injected into calves which have previously had an *A. marginale* or a *G. mutans* infection will also provoke a relapse of these diseases. In calves free from such infection severe anemic changes are produced in the blood. In dogs, rabbits, and guinea pigs severe anemia and death may be produced by the injection of pyrogallie acid, nitrobenzene, or phenylhydrazine. Jolly bodies appear in the blood, but a blood picture which could be compared with that of anaplasmosis in cattle was never observed. *A. marginale* of cattle can not be regarded as a degenerative product of the red blood corpuscles. It can not be produced by the injection of poisonous substances.

"If virulent anaplasmosis blood is hemolyzed and filtered through a Berkefeld candle, the filtrate is nonvirulent, whereas the unfiltered hemolyzed blood produces anaplasmosis. The virus of anaplasmosis can not be separated from the red blood corpuscles by means of washing and centrifuging. The washed red blood corpuscles produce the disease in the typical way. The virus, therefore, is contained in the red blood corpuscles and, when liberated, does not pass through a bacterial filter. The simplest and most natural explanation for these facts is that *A. marginale* is an endoglobular parasite and the actual cause of anaplasmosis. By analogy with piroplasmosis and in the light of recent work, it is reasonable to regard *A. marginale* as belonging to the protozoa."

Bacillus oedematiens infection in cattle, T. J. BOSWORTH and L. JORDAN (*Vet. Jour.*, 85 (1929), No. 652, pp. 393-399).—The authors conclude that a recent outbreak of disease in young cattle in west Norfolk, England, which they investigated was due to *B. oedematiens*. The disease occurred in 2 herds with 180 head of 8-months-old cattle on two adjoining farms, the 13 that were attacked succumbing to the disease within from 24 to 48 hours of the onset of the symptoms.

Observations on the use of ovarian extract in the treatment of sterility in cattle, E. R. FRANK (*Cornell Vet.*, 19 (1929), No. 4, pp. 399, 400).—Satisfactory results were obtained in 6 of 7 cases treated with ovarian extract.

Toxicity of sodium chlorate (NaClO_3) for cattle, C. P. FITCH, W. L. BOYD, and E. A. HEWITT (*Cornell Vet.*, 19 (1929), No. 4, pp. 373-376).—This is a brief report of studies conducted at the Minnesota Experiment Station on the effect upon cattle of sodium chlorate, which had been recommended by the station for use in weed destruction. The results obtained indicate clearly its toxicity for cattle when administered in the crystal form.

Arsenical poisoning in the field, U. F. POLLOCK (*Vet. Jour.*, 85 (1929), No. 651, pp. 372-377).—This account is based upon personal investigations of cases observed in the tick quarantine area of New South Wales.

Pathogenic spore-bearing anaerobes in the carcasses of sheep, I. E. NEWSOM, F. CROSS, and H. S. DOBINS (*Jour. Infect. Diseases*, 45 (1929), No. 5, pp. 336-352).—This is a contribution from the Colorado Experiment Station in which during a period of two years the authors examined the carcasses of 200

animals with a view to determining the presence of the spore-bearing pathogenic anaerobes in the tissues of a series of sheep without regard to the clinical diagnosis.

It was found that pathogenic spore-bearing anaerobes may be isolated from the spleens of a considerable proportion of sheep dead of a variety of diseases. In the case of *Clostridium oedematis* the longer the animal has been dead the greater is the likelihood of its presence in the spleen. This organism is not, however, the cause of the disease described by the authors as overeating. It is pointed out that caution should be exercised in attributing etiologic significance to its presence in the tissues of sheep.

The bionomics of *Fasciola hepatica* in New South Wales and of the intermediate host, *Limnea brazieri* (Smith), I. C. ROSS and A. C. MCKAY (*Aust. Council Sci. and Indus. Research Bul.* 48 (1929), pp. 62, figs. 13).—This is an extended report of the bionomics of *F. hepatica* in *L. brazieri*, the bionomics of *L. brazieri*, and treatment and control of fluke infestation of sheep in Australia.

Vaccination of the goat against *Micrococcus melitensis* infection, M. ASCOLI and E. SANFILIPPO (*Jour. Trop. Med. and Hyg.* [London], 32 (1929), No. 20, pp. 289, 290).—The authors' work has led to the conclusion that a clear immunity can be established in goats against *M. melitensis* infection by massive injection of at least 12 to 16 platefuls of culture on two occasions with an interval of 8 days.

The development of *Metastrongylus elongatus* and *M. pudendotectes* in their intermediate hosts, B. SCHWARTZ and J. E. ALICATA (*Jour. Parasitol.*, 16 (1929), No. 2, p. 105).—This is an author abstract of a paper presented at the fifth annual meeting of the American Society of Parasitologists, held at Des Moines, Iowa, in December, 1929.

The larvae of the swine lungworms *M. elongatus* and *M. pudendotectes* are ingested by earthworms with the soil which has become contaminated with the swine dejecta. Gaining access to the digestive tract the larvae penetrate the walls of the esophagus, especially in the posterior part of this organ, and also penetrate the walls of the crop. The larvae have occasionally been found in the walls of the anterior part of the stomach-intestine. In these locations they remain more or less quiescent and grow appreciably from day to day, practically doubling their size in about 8 or 9 days. Prior to the first molt and also after this has taken place, the larvae often begin to work their way into the circulatory system, reaching the dorsal blood vessel by way of the efferent intestinal blood vessels. From the dorsal blood vessel the larvae enter the so-called "hearts," in which they are usually arrested. Migrating larvae have been encountered in the circulatory system as early as the seventh day following experimental infestation. Evidence of the first molt was found on the eighth day and of the second molt on the ninth day after the swallowing of larvae by earthworms.

Skin reactions in experimental trichinosis in pig, B. SCHWARTZ and A. MCINTOSH (*Jour. Parasitol.*, 16 (1929), No. 2, pp. 104, 105).—This is the authors' abstract of a report on investigations in which 12 pigs experimentally infested with *Trichinella spiralis* were injected intracutaneously at various intervals thereafter with an extract of pure pulverized trichina larvae in Coca's solution.

Eight pigs injected with the extract 10 days after the experimental infestation yielded negative results, as did 3 of 4 that were injected after 15 days, the fourth showing a slight though definite reaction. Twenty-three days after the experimental infestation, 7 of 8 pigs injected yielded positive results with a marked reaction in 1, while the reactions in 6 were light. The pig in this series which yielded negative results, and which was found to be infested with trichinae at autopsy, apparently succumbed to the infestation.

"The skin reactions gradually increased in intensity, and about 2 months after experimental infestation nearly all the pigs gave marked reactions to intradermal injections of trichina extract. In the early stages of the disease the reaction was characterized by a slight swelling which was usually hyperemic; later it was characterized by a large edematous swelling and hyperemia. In the more striking reactions the skin commonly showed evidence of hemorrhage in the reaction area. The reaction to the injections developed slowly, became quite pronounced within 4 to 5 hours, and was usually still pronounced at the end of 24 hours, although light reactions faded out considerably during this period. Several nontrichinous pigs injected with trichina antigen yielded negative results or gave very slight indefinite reactions."

Eradicating dourine in Arizona, T. W. CRUMP (*Vet. Med.*, 24 (1929), No. 12, pp. 503-507, figs. 3).—An account is given of eradication work with dourine in Arizona, where it has existed on the range of the Navajo Indian reservation for many years but now seems to have been eradicated.

The sources of rabies virulence: History of an epizootic of rabies in the fox and badger in the region of Dijon, A. BARBIER (*Les Sources de la Virulence Rabique: Histoire d'une Epizootie de Rage sur le Renard et le Blaireau dans la Région Dijonnaise*. Dijon [France]: Impr. Bernigaud & Privat, 1929, pp. 253, pl. 1, figs. 3).—The first part of this account deals with the nature of the rabies virus (pp. 13-58), the second part with the animal sources of the virus (pp. 59-191), and the third part with the removal of the sources of infection (pp. 193-215). A 28-page list of references to the literature is included.

Normal leucocyte content of birds' blood, P. KYES (*Anat. Rec.*, 43 (1929), No. 2, pp. 197, 198).—The author has found that the number of leucocytes in the blood of the normal pigeon and the domestic fowl is from 8,000 to 13,000 per cubic millimeter, and concludes that the leucocytic content of birds' blood is approximately the same as that of mammals. A diluting fluid capable of rapid cell fixation was used. It was found that when 2 per cent osmic acid was used at 43° C., with the pipette and counting chamber also at that temperature, no hemolysis occurs and the complicating stromata are absent.

Poultry diseases and their treatment, L. M. GREENE (*Vt. Agr. Col. Ext. Circ.* 54 (1929), pp. 30, figs. 22).—This is a practical account.

The production of gas by *Salmonella pullorum*, II, J. C. WELDIN and H. J. WEAVER (*Rhode Island Sta. Bul.* 222 (1929), pp. 25).—This is a report of further studies on the subject (*E. S. R.*, 57, p. 576) in which 100 strains were tested, only 4 supposedly anaerogenic strains having been used in the earlier work by Goodner and May. Of the four temperatures for incubation tested, namely, 25, 30, 37, and 40° C., a 30° temperature was found to be most conducive for gas production in dextrose broth by *S. pullorum*.

"Out of 100 strains tested, 8 were found to be anaerogenic at all incubation temperatures. While the majority of the aerogenic organisms produced gas in 24 hours' incubation at 30 or 37°, it is unsafe to label an organism as being anaerogenic without at least 48 hours' incubation at these temperatures and for a longer period if 25 or 40° is used. Prolonged cultivation upon artificial media does not seem to materially change the gas fermenting ability of the organisms. Infusion broth as a base for sugar media is conducive to greater gas production than is meat extract broth. However, all organisms which were anaerogenic in meat-extract dextrose broth remained anaerogenic when grown in infusion dextrose broth. An incubation temperature of 30° is more favorable for gas production by *S. pullorum* in mannitol broth than is 25, 37, or 40°. All organisms which failed to produce gas from dextrose, also, as might be

expected, failed to produce any from mannitol. The buffer content of a sugar broth has an influence upon the amount of gas produced by *S. pullorum*. The addition of peptone to the medium, however, brings about an increase in gas production considerably out of proportion to the increase in buffer content.

"The highest average gas production secured with 20 strains of *S. pullorum* was in a medium having the following composition: Salt 1 per cent, dextrose 1 per cent, meat extract 0.5 per cent, peptone 1 per cent, K_2HPO_4 0.5 per cent, distilled water. H-ion concentration adjusted to give a pH of 6.8 to 7 after sterilization. There seems to be no correlation between anaerogenicity and pathogenicity of *S. pullorum* strains. Anaerogenic strains were isolated from naturally infected chicks as well as from adult birds. Passage of strains of *S. pullorum* through chicks does not materially change their gas-fermenting ability. Cross-agglutination tests between aerogenic and anaerogenic strains indicates a serological identity."

Infectious diarrhea "kiifun" in Japan (bacillary white diarrhea of chicks in Japan) [trans. title], T. KONNO (*Deut. Tierärztl. Wchnschr.*, 37 (1929), No. 31, pp. 482-487).—The author reports studies of an affection of chicks known in Nagoya, central Japan, for about 30 years under the name "kiifun." This has been found to be the same as the bacillary white diarrhea or pullorum disease of chicks in America and Europe.

The results of repeated testing by the agglutination method for the detection of bacillary white diarrhea in adult chickens, H. C. H. KERNKAMP (*Cornell Vet.*, 19 (1929), No. 4, pp. 357-369).—This is a report of agglutination testing conducted at the Minnesota Experiment Station in which a considerable variation was found in the reactions.

An apparatus for pipetting serum in making the agglutination test for the detection of carriers of bacillary white diarrhea, F. R. BEAUDETTE (*Cornell Vet.*, 19 (1929), No. 4, pp. 377-381, figs. 2).—An apparatus devised at the New Jersey Experiment Stations is described and illustrated.

The question of spontaneous infection of the fowl with the virus of equine infectious anemia [trans. title], OFFERMANN, DÖPELHAUER, and MOLL (*Deut. Tierärztl. Wchnschr.*, 37 (1929), No. 26, pp. 401, 402, figs. 2).—The authors have found that the fowl contracts anemia spontaneously when inoculated with the virus, resulting in changes in the liver. Two equines, one 8 months and the other 4 years old, were experimentally inoculated through the injection of organ tissues and blood from infected fowls, typical symptoms of the disease resulting. The details of the blood picture and temperature are reported in chart form.

On the diphthero-variola affection of domestic fowl [trans. title], J. LAHAYE (*Ann. Méd. Vét.*, 74 (1929), No. 7, pp. 289-312, figs. 2).—This is a report of studies conducted in continuation of those previously noted (*E. S. R.*, 60, p. 275), with references to the literature.

The author holds that there are two forms of the diphthero-variola (epithelioma contagiosa) virus, one occurring in the domestic fowl and the other in the pigeon. These viruses are not the same as those occurring in other animals, and they can not be transformed into a vaccine by physicochemical means. Neither are they transformed into a vaccine by passage through the bodies of other animal species. They can be attenuated by successive passages through the species in which they originated; thus, the virus occurring in the Gallinaceae is attenuated by passage through the fowl and that in the Columbinae by passage through the pigeon. The epithelioma virus of the Columbinae is attenuated to the extent that it can be utilized to prepare an effective vaccine for the pigeon. That of the Gallinaceae developed in the

body of the bovine becomes of little value as a vaccine for the fowl. The epithelioma virus of the pigeon is cultivated better in the bovine than is that of the fowl and acquires properties which render it more desirable for the vaccination of the Gallinaceae. The diphthero-variola virus of the pigeon constitutes a vaccine effective against the diphtheria of the common fowl.

The diphthero-variola of domestic fowl [trans. title] (*Ann. Méd. Vét.*, 74 (1929), No. 12, pp. 506-515).—This consists of a communication addressed by J. Basset to M. Rubay regarding work with fowl pox, particularly that of Lahaye above noted.

Vaccination against fowl pox and fowl diphtheria [trans. title], W. ZWICK, O. SEIFRIED, and J. SCHAAF (*Ztschr. Infektionskrank. u. Hyg. Haustiere*, 34 (1928), No. 3-4, pp. 300-341, pls. 5; abs. in *Internat. Rev. Poultry Sci.*, 2 (1929), No. 1, p. 30).—This is a report of studies conducted, presented in connection with a list of 127 references to the literature.

It is concluded that poultry vaccinated with the cow-pox virus do not develop any immunity against the fowl-pox virus, and that sheep-pox virus acts very weakly. A mammalian-pox virus can not be used as a vaccine against fowl pox.

Experimental attempts to change the character of fowl-pox virus by the inoculation of either rabbits or dogs were not successful, but an attempt to infect cattle with fowl-pox virus by first passing it through the sheep or rabbit succeeded. This so-called gallin has little value as a vaccine for hens against artificial infection, but satisfactory results were obtained in field experiments. By the symbiotic cultivation of cow-pox virus and fowl-pox virus in the bovine it was found possible to produce a double vaccine very active against fowl pox. The pigeon-pox virus gave a very active vaccine, and outbreaks were quickly controlled both by use of the pigeon-pox virus and by the gallin vaccine.

It is concluded that vaccination is best carried out by rubbing the vaccine into the feather follicles of the leg.

Omphalitis in baby chicks and turkeys, F. VOLKMAR (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 5, pp. 647-649).—This is a contribution from the North Dakota Experiment Station in which the author reports having traced a series of outbreaks of baby chick and baby turkey mortality to inflammation and infection of the navel.

Piropasmosis in Egyptian fowls (*Egyptianella pullorum*), M. CARPANO, trans. by Z. MORCOS (*Egypt Min. Agr., Tech. and Sci. Serv. Bul.* 86 (1929), pp. 7, pls. 3).—Under the name *E. pullorum* n. g. and sp. the author describes a piropasmid found attacking fowls in Egypt. Since some of the fowls were suffering from a double infection of *E. pullorum* and *Spirochaeta gallinarum*, it is thought that the former as well as the latter may be transmitted by the fowl tick. Imported birds show acute symptoms for several days ending in death in most cases, but crossbred birds of foreign and native origin show a subacute or chronic form, also ending in death in many cases.

Carbon tetrachloride as an anthelmintic for the roundworm, *Ascaridia lineata* Schneider, in growing chickens, G. L. GRAHAM and J. E. ACKERT (*Jour. Parasitol.*, 16 (1929), No. 2, p. 98).—This is the authors' abstract of a paper presented at the fifth annual meeting of the American Society of Parasitologists, held at Des Moines, Iowa, in December, 1929. In work at the Kansas Experiment Station the authors have found that carbon tetrachloride administered to chickens at the rate of 6 and 4 cc. per kilogram removed all the worms (*A. lineata*) with scarcely any ill effect upon the chickens.

The *Eimeria* of domestic rabbits, J. F. KESSEL (*Jour. Parasitol.*, 16 (1929), No. 2, p. 100).—This is an abstract of a paper presented at the fifth annual

meeting of the American Society of Parasitologists. The author's studies of the domestic rabbit at the University of Southern California have shown that one species, *E. stiedae*, inhabits the liver, while four species, including *E. magna*, *E. perforans*, and *E. media* n. sp., inhabit the intestine.

AGRICULTURAL ENGINEERING

Agricultural engineering research opportunities in the North Atlantic States, R. W. TRULLINGER (*Agr. Engin.*, 10 (1929), No. 12, pp. 375-379, figs. 3).—In a contribution from the U. S. D. A. Office of Experiment Stations a brief review is presented of the more important features of agricultural research in the North Atlantic States for the purpose of drawing attention to the numerous points of profitable contact for agricultural engineering.

"It does not appear particularly necessary for agricultural engineers to look beyond the existing programs of research in their own experiment stations to find opportunities for profitable research activity. Therefore, the engineers should become fully acquainted with those programs and the agricultural specialists in charge in order to identify the most profitable points of contact and conduct investigations of these features on a fully cooperative basis."

Ground water level investigation [trans. title], O. FRANCK (*Meddel. Centralanst. Försökn. Jordbruksområdet [Sweden]*, No. 353 (1929), pp. 45, figs. 12; *Eng. abs.*, pp. 42, 43).—The results of nine years' experiments are reported which showed the importance of depth of water table in soils on crop yield. Lowering the water table to a considerable depth in soils of low water capacity and capillarity was unfavorable to shallow rooting crops.

With reference to the proper depth of water table it was found that on soils consisting of heavy clay, poor in humus and of rather unfavorable physical conditions, the depth of the ground water should be somewhat more than 75 cm. (2.5 ft.). For root crops (turnips), however, the ground water should have a depth of about 100-125 cm. In an alluvial clay, rich in humus and of good capillarity, a depth of the ground water of 100-125 cm. is desirable for most cultivated plants and for turnips a still greater depth. In a deep peat soil, well humified and of good quality in every respect, different depths of the water table within the tested limits showed only a small influence on the yield. A depth of about 100 cm. was the most suitable.

The mechanics of shear failures on clay slopes and the creep of retaining walls, C. TERZAGHI (*U. S. Dept. Agr., Public Roads*, 10 (1929), No. 10, pp. 177-192, figs. 21).—A digest of the published data concerning friction and cohesion of clay soils is presented which discloses the fact that the angle of internal friction of such soils is exceedingly small as compared with the slopes of cuts and fills. Hence, the stability of all clay fills and clay cuts depends essentially on cohesion. Due to this fundamental fact, the factor of safety of slopes with a given inclination rapidly decreases beyond the critical height at which the soil can stand with a vertical face. Hence, a stable fill of a certain height and consisting of a certain clay soil is no indication of stability in a fill of twice that height, with the same slope and consisting of the same material. In computing the factor of safety of a cut or fill the curvature of the sliding surface must be taken into account, else the results of the computation may be very misleading.

A graphical procedure is presented which furnishes the means of making stability computations rapidly. The figures furnished by the computation of the stability of retaining walls only inform about the stability of the walls with regard to the forces produced by the inert weight of the back fill. There

exists the possibility of the occurrence of forces which tend to press the wall gradually out of its original position and which are entirely independent of the active earth pressure. No relation seems to exist between these forces and the active earth pressure of the back fill. The intensity of the active earth pressure depends on the unit weight, the internal friction, and the cohesion of the back fill, while the forces which tend to displace the wall gradually depend on the elastic properties of the back fill, its structure, and on the climatic conditions. The current practice for considering the existence of these non-gravitational forces consists in computing the retaining walls as if cohesion were nonexistent. Due to the absence of any causal relation between the active earth pressure and the nongravitational forces, this practice, under favorable conditions, leads to structures with an excessive factor of safety and which are uneconomical. On the other hand, under favorable soil and climatic conditions the walls are apt to yield gradually in spite of the apparent additional safety obtained by neglecting cohesion. In order to reduce the uncertainty associated with the design of retaining walls and abutments, a systematic investigation of existing retaining walls and abutments is considered highly desirable.

Resistance of metals suitable for dies to the abrasive action of plastic clay (*Jour. Franklin Inst.*, 208 (1929), No. 4, pp. 555, 556).—The results of studies conducted at the U. S. Bureau of Standards on the wearing action of plastic clay on cast iron and carbon-chrome steel are reported.

During each test a definite volume of clay is extruded through the die specimen in a definite time and the abrasive loss of the die is expressed in terms of volume. This is determined by dividing its loss in weight by the specific gravity of the metal.

A very small decrease in water content of the clay produces a marked increase in the pressure necessary to extrude the clay at a definite rate, and the abrasive loss of the die increases with the extrusion pressure. The data obtained from 54 tests indicate that the relation between extrusion pressure and abrasion loss of the metal is a "straight line" function, according to the equation $PS/W=K$, in which P is the extrusion pressure, W the loss of the metal in weight, S the specific gravity of the metal, and K is a constant characteristic of the wearing quality of the metal. The value of K for the cast-iron die as compared to that for the carbon-chrome steel die is as 1 to 10.116.

Studies on the action of sulphates on Portland cement, I—III (*Canad. Jour. Research*, 1 (1929), Nos. 3, pp. 273–284, pl. 1; 4, pp. 359–384, figs. 4; 5, pp. 385–399).—This contribution from the University of Saskatchewan and the National Research Council of Canada is in three parts.

I. *The use of the expansion method in the study of the action of sulphates on Portland cement mortar and concrete*, T. Thorvaldson, D. Wolochow, and V. A. Vigfusson.—This describes the methods employed in the use of expansion measurements as a means of studying the action of sulfates on Portland cement and on Portland cement mortars. Experimental data are given dealing with the reproducibility of the expansion measurements and the relation between expansion and loss of tensile strength of mortars. Results obtained with standard sand mortars and graded sand mortars of varying richness of mix prepared from cements which differ in their resistance to sulfate action are presented.

II. *Steam-curing of Portland cement mortar and concrete as a remedy for sulphate (alkali) action*, T. Thorvaldson, V. A. Vigfusson, and D. Wolochow.—Studies are reported of the effect of steam curing at various temperatures between 50 and 200° C. on the resistance of Portland cement mortars to the action of solutions of the sulfates of sodium, magnesium, and calcium. The

methods used consisted in comparing the expansion of steam-cured and untreated mortar specimens during exposure to the solutions, and in determining the changes in the tensile strength of the more resistant mortars after long periods of exposure.

A laboratory study of steam curing as a remedy for the action of sulfates (alkali) on Portland cement mortars was made by determining the effect on the stability of the mortar as indicated by changes in volume and in tensile strength on exposure to sulfate solutions at 21°. The effect of steam curing on the tensile and compressive strength of mortars and concrete was also studied.

Curing in water vapor at temperatures below 100° is of doubtful value on account of the loss in strength occurring during treatment. At a temperature of 50° it decreases the resistance to the action of sulfates. Steam curing at 100° for 24 hours or more very materially increases the resistance of the mortar to the action of sulfates. The expansion of the specimens in solutions of sodium and calcium sulfate may thus be reduced to very small proportions, and the loss of strength greatly delayed. In solutions of magnesium sulfate the expansion is retarded, and the specimens gain strength as the volume increases up to a critical point at which they begin to develop cracks and lose their strength. The deterioration of the mortar is thus due mainly to gradual loss in strength in solutions of sodium sulfate or calcium sulfate, and to gradual increase in volume in solutions of magnesium sulfate.

The steam treatment at 100°, however, produces mortars of low tensile strength. Therefore, while the treatment may increase almost indefinitely the life of a specimen exposed to solutions of sodium sulfate and calcium sulfate under laboratory conditions and increase the life of specimens exposed to solutions of magnesium sulfate to from 10 to 100 times that of an untreated mortar, steam-cured specimens are likely to fail when exposed to high concentrations of sulfates under severe climatic conditions.

The disadvantage of low tensile and compressive strength in steam-cured mortar or concrete may be entirely avoided and material of much higher resistance to sulfate solutions obtained by curing in steam under pressure at 125 to 175° for 24 hours or more. The increase in volume and loss of strength of the mortar, in solutions of sodium and calcium sulfate, may thus be almost eliminated, and the expansion in solutions of magnesium sulfate reduced considerably.

The results obtained in the laboratory indicate that pre-cast concrete, such as tile of medium richness of mix made with clean siliceous aggregate, can be rendered practically resistant to moderate concentrations of alkali. Where the concrete is placed outside of the reach of frost action and high strength is not necessary, steam curing at 100° for 24 hours or more may be sufficient. For concrete exposed to high concentrations of alkali, especially of magnesium sulfate, and to large variations of temperature, the steam curing should be carried on in saturated steam at 150 to 175° for a period of at least 24 hours.

III. *The effect of the addition of silica gel to Portland cement mortars on their resistance to sulphate action*, T. Thorvaldson, V. A. Vigfusson, and D. Wolochow.—Studies are reported in which the effect of substituting silica gel for a portion of the Portland cement in standard and graded-sand mortars on the expansion and loss in strength of the mortars in sulfate solutions was determined. Portland cement silica gel sand mortars were cured in steam at 100° C. and the effect on their sulfate resistance measured. The behavior of lime-silica gel sand mortar in solutions of sodium and magnesium sulfate was also studied.

It was found that the addition of silica gel to the mortar, very effective in preventing expansion and maintaining the tensile strength of the mortar in solutions of sodium and calcium sulfate, was not so effective in solutions of

magnesium sulfate. Steam-cured mortars containing silica gel to the extent of 20 per cent of the cement present showed a slightly greater resistance to the action of solutions of sodium and calcium sulfates, but less resistance in solutions of magnesium sulfate, than similar steam-cured mortars containing no silica gel. Lime-silica gel sand mortars behaved very similarly in sulfate solutions as Portland cement mortars containing silica gel. The possible causes of the effects produced by the addition of silica gel to Portland cement mortars are considered, and several explanations discussed.

Estimation of brushing and flowing properties of paints from plasticity data, R. V. WILLIAMSON, G. D. PATTERSON, and J. K. HUNT (*Indus. and Engin. Chem.*, 21 (1929), No. 11, pp. 1111-1115, figs. 4).—The failure of yield value and mobility constants in the equation of flow for an ideal plastic to serve as a measure of the brushing and flowing properties of paints is considered to be due to two causes. First, the resistance to shear of a plastic substance varies with the rate of shear; consequently, the flowing properties of a plastic under any given practical conditions depend upon its resistance to shear at the particular rate of shear characteristic of those conditions. The individual values of the yield value and mobility constants do not show the variation in resistance to shear with rate of shear. Second, paints of brushing consistency do not flow in accordance with the law of ideal plastic flow.

Estimation of the relative brushing and flowing properties of paints from plasticity data is shown to be possible if the apparent fluidities or viscosities are compared at rates of shear characteristic of the practical conditions.

The application of a new equation for calculating apparent fluidities or viscosities at any rate of shear and the use of the constants of this equation as a measure of false body are given.

A method is presented for estimating the rate of shear characteristic of average brushing conditions or of other practical tests in which flow of pseudo-plastic dispersions occurs.

Gaseous explosions.—VII, Effect of tetraethyl lead on rate of rise of pressure, M. S. CARR and G. G. BROWN (*Indus. and Engin. Chem.*, 21 (1929), No. 11, pp. 1071-1078, figs. 12).—In experiments (E. S. R., 58, p. 484) conducted at the University of Michigan explosive mixtures of different types of hydrocarbons were prepared containing varying amounts of tetraethyl lead. The rate of rise of pressure following ignition was determined from pressure-time curves.

The effect of tetraethyl lead was found to be essentially independent of the chemical structure of the fuel, but governed by the type or rate of combustion of the explosive mixture. As the rate of reaction increases, the retarding action of tetraethyl lead disappears and is replaced by an accelerating action on the combustion. A similar effect was observed upon adding increasing amounts of tetraethyl lead to the mixture. Small amounts of tetraethyl lead tend to retard slow combustion, but larger concentrations of tetraethyl lead showed no retarding action and in many cases a positive accelerating effect.

These actions may be explained on the assumption that the decomposition products of tetraethyl lead are the active agents, and by considering the relative rates of decomposition of tetraethyl lead and of reaction of the explosive mixture.

Carbon deposits from lubricating oils, C. J. LIVINGSTONE and W. A. GRUBE (*Indus. and Engin. Chem.*, 21 (1929), No. 10, pp. 904-908, figs. 4).—Experiments conducted at the Mellon Institute of Industrial Research with heavy duty sleeve-valve and poppet-valve engines are reported. It was found that in sleeve-valve engines paraffinic oils differing markedly in carbon residue value

differed only slightly in amount of carbon deposited, while a naphthenic oil was greatly superior to both. For poppet-valve engines the laboratory experiments indicate that the carbon residue value remains a fairly reliable index of the carbon deposit to be expected.

Carbon deposits with heavy-duty engines, C. J. LIVINGSTONE, E. C. MARTIN, and S. P. MAYLEY (*S. A. E. [Soc. Automotive Engin.] Jour.*, 25 (1929), No. 5, pp. 489-494, figs. 3).—The substance of this report is noted in the above.

The trend in rural electrification, W. C. KRUEGER (*Agr. Engin.*, 10 (1929), No. 12, pp. 380-382).—In a contribution from the New Jersey State College a brief review of accomplishments in rural electrification is presented.

The individual plant in rural electric development, J. E. WAGGONER (*Agr. Engin.*, 10 (1929), No. 12, pp. 390-392, fig. 1).—A summary of practical information is given regarding the individual electric plant.

Filling silos with a 3-hp. motor, J. M. LARSON (*Agr. Engin.*, 10 (1929), No. 12, pp. 393, 394, figs. 3).—Experiments conducted at the Minnesota Experiment Station are reported which showed that a large power unit is not necessary for silo filling since as small a motor as one of only 3 h. p. can handle the job at a fairly good rate. The motor can be mounted on a cutter so as to make a convenient, compact unit, and maintain a tight belt only when a tight belt is needed and a slack one when the load is light, thus saving the motor bearing.

Research in mechanical farm equipment, 1928, R. W. TRULLINGER (*Agr. Engin.*, 10 (1929), No. 11, pp. 357-360, figs. 2).—In a contribution from the U. S. D. A. Office of Experiment Stations, a critical review of the status of mechanical farm equipment research during 1928 is presented, attention being drawn to typical outstanding results obtained as an argument for defining and clarifying any field of research. That process, as applied to mechanical farm equipment, has revealed the existence of a large number of important mechanical problems in programs of agricultural research, the most of which materially affect the economy and efficiency of some line of agricultural production. In most instances noted the need for engineering investigation arises from some very definite agricultural problem. In practically every instance the proper line of attack calls for the coordination of the efforts of agricultural engineers with those of agronomists, soil technologists, and other subject-matter specialists, in the study of specific mechanical problems.

A simple sweet potato vine cutter, J. C. C. PRICE (*Mississippi Sta. Circ.* 84 (1929), pp. 3, figs. 2).—This device is briefly described and illustrated.

Spraying from stationary plants, E. R. GROSS (*Agr. Engin.*, 10 (1929), No. 12, pp. 385, 386, fig. 1).—In a contribution from the New Jersey Experiment Stations a brief review of present practice in the State in orchard spraying from stationary plants is given.

The bin method of drying seed corn, A. H. WRIGHT and F. W. DUFFEE (*Madison: Wis. Univ., Col. Agr.*, 1929, pp. 12, figs. 5).—The method is described and illustrated.

Industrial refrigeration, cold storage, and ice-making, A. J. WALLIS-TAYLOR, edited by R. J. CRACKNELL (*London: Crosby Lockwood & Son*, 1929, 7. ed., rev. and enl., pp. XI+776, figs. 523).—This is a practical treatise on the subject (*E. S. R.*, 44, p. 487), which includes chapters on origin of artificial refrigeration, the theory and practice of mechanical refrigeration, the liquefaction process, the vacuum process, the compression process or system, condensers and water cooling and saving apparatus, the absorption and binary absorption process or system, the cold-air system, cocks, valves, and pipe joints and unions, refrigeration and cold storage, marine refrigeration, refrigeration in dairies, manufacturing, industrial, and constructional applica-

tions, ice making, the management and testing of refrigerating machinery, cost of working, the production of very low temperatures, the design of refrigerating machines, and household and small commercial plants.

Economical thickness of heat insulation, R. H. HEILMAN (*Heating, Piping and Air Conditioning*, 1 (1929), No. 7, pp. 544-551, figs. 4).—Graphical and mathematical data are presented for the use of engineers in the design of heat insulation.

Suggestions for rural house planning (*Mont. Agr. Col. Ext. Bul.* 102 (1929), pp. 70, figs. 39).—Practical suggestions are given on the subject, together with sample plans.

Winter windows need weatherstripping, J. WORTH (*Building Age*, 51 (1929), No. 11, pp. 62, 63, figs. 3).—A brief summary of evidence in favor of weatherstripping of residence windows is given, together with practical information on the practice.

The installation of farm water systems, J. P. SCHAEZNER and F. W. DUFFEE (*Agr. Engin.*, 10 (1929), No. 11, pp. 361-363, figs. 3).—In a contribution from the Wisconsin Experiment Station technical information for the use of engineers is presented on the installation of farm water systems.

Disposal of farm sewage, G. O. HILL (*Purdue Agr. Ext. Bul.* 165 (1929), pp. 12, figs. 6).—Practical suggestions are given on the subject, together with working drawings of disposal systems and equipment.

Studies on Raritan River pollution, 1927-28, W. RUDOLFS ET AL. (*New Jersey Stas. Bul.* 489 (1929), pp. 72, figs. 28).—The results of a chemical and biological study of the Raritan River and its tributaries made during the different seasons of one year are reported. These show that the whole lower river and all its tributaries are polluted. The greatest pollution occurs in the Raritan River below the town of New Brunswick, because of the accumulative effect of the discharge of raw sewage and trade wastes along the banks of the river and its tributaries.

Bacteriological results show that a positive potential danger exists to public health in the whole lower river basin.

Chemical results show that oxygen consumption in the river is greater than the oxygen supply; that considerable amounts of acids, alkalis, dyes, poisons, and inert substances are discharged into the river and its tributaries; and that the raw sewage from about 150,000 people is augmented by a pollution equivalent of about 85,000 people from industries. The domestic and trade wastes pollution is injurious to fish life, especially during the summer months.

RURAL ECONOMICS AND SOCIOLOGY

[Papers presented at the nineteenth annual meeting of the American Farm Economic Association] (*Jour. Farm Econ.*, 11 (1929), No. 4, pp. 525-589).—Included are the following additional papers and discussions thereon presented at the meeting of December, 1928 (E. S. R., 62, p. 276): Analysis of the Relation of Quality to Price of Cotton, by B. Youngblood (pp. 525-541); Relation of the Price and Quality of Cotton, by A. B. Cox (pp. 542-549); The Farmer's Interest in Various Types of Roads, and Its Bearing on Financing Road Building, by J. G. McKay (pp. 550-564); The Economics of Consumption as a Field for Research in Agricultural Economics, by W. C. Waite (pp. 565-577); and Experimental Method in Economic Research, by M. L. Wilson (pp. 578-583), W. E. Grimes (pp. 584-586), and C. C. Taylor (pp. 587-589).

Experimental method in economic research (*Jour. Farm Econ.*, 11 (1929), No. 4, pp. 590-596).—Supplementing those noted above, additional papers on

this subject by G. W. Forster (pp. 590, 591), M. R. Benedict (pp. 592, 593), and F. F. Elliott (pp. 594-596) are presented.

Farm budgeting in Germany, W. J. ROTH (*Jour. Farm Econ.*, 11 (1929), No. 4, pp. 623-632).—The attitude of German economists toward farm budgeting and the use of budgets in their investigations are briefly discussed.

Scope and methods of research in land utilization, D. WEEKS (*Jour. Farm Econ.*, 11 (1929), No. 4, pp. 597-608).—The types of investigations in land utilization being undertaken in the United States and the methods used are discussed.

Large land holdings and their operation in twelve Ohio counties, P. G. MINNEMAN and J. I. FALCONER (*Ohio State Univ., Dept. Rural Econ. Mimeogr. Bul.* 17 (1929), pp. 31, fig. 1).—This is a mimeographed report of a study made in 1928 of 123 over-500-acre land holdings in 12 representative counties. The physical characteristics, proprietorship, methods of administration and management, and the changes and adjustments in management are discussed.

About 60 per cent of the holdings were owned by farmers, of which about one-third of the land had been inherited. Corporations other than banks owned only 5 per cent. Of the total land, 46 per cent was operated by hired labor, 52 per cent by tenants, and 2 per cent was idle. The trend was found to be toward operation by tenants. Ownership of farm real estate in the State by 14 life insurance companies on January 1, 1929, consisted of 257 farms, totaling 39,794 acres, the increase in acreage acquired in 1928 being 23,347 acres as compared with 8,050 acres in 1927.

The farm real estate situation, 1928-29, E. H. WIECKING (*U. S. Dept. Agr. Circ.* 101 (1929), pp. 67, figs. 6).—The changes in farm real estate values and farm ownership and the situation in farm credit and farm real estate taxes during the year ended March 1 or March 15, 1929, are analyzed and discussed for the United States as a whole, the different geographic divisions, the chief production areas, and some individual States. The method of analysis and tables and graphs included follow in general the same plan as for the previous year (*E. S. R.*, 61, p. 79).

The net change in the estimated value per acre for the year beginning March 1, 1928, from the previous year was -1 per cent for the United States, being -1 per cent in 7 of the geographic divisions with no change in 2. The national agricultural income available for capital invested in the entire industry was slightly higher than the previous year. The average net cash returns for the calendar year 1928 of approximately 12,000 farmers reporting to the Bureau of Agricultural Economics represented a 3 per cent gain over 1927. The ratio of prices received by farmers to prices paid by them for goods bought at retail averaged 90 per cent of the pre-war parity, being the highest annual average but one since 1920. Farm taxes in 1928 averaged 262 per cent of pre-war taxes as compared with 258 per cent in 1927. The bankruptcy rate per 1,000 farms declined to 0.89 as compared with 0.99 in 1927. Forced sales and related losses of title through financial default (but exclusive of sales for delinquent taxes), and voluntary sales per 1,000 farms in 1928-29 were 19.4, 14.7, and 24, respectively, as compared with 22.8, 17.6, and 26 for the previous year.

Taxes on farm and urban real estate in Virginia, R. A. BALLINGER and W. COOMBS (*Virginia Sta. Bul.* 268 (1929), pp. 30, figs. 8).—This study was conducted in cooperation with the U. S. D. A. Bureau of Agricultural Economics. Information was obtained by the survey method during the summer of 1927 and the winter of 1927-28 from 1,093 rented farms with a total of 245,492 acres in 33 counties and from 889 urban properties in 33 towns and cities.

Data were secured for the year 1926 regarding rents received, taxes, assessed value, and estimate of sale value made by owners in the case of the farms.

Information was also obtained regarding the income and taxes of corporations from the Institute of Research in the Social Sciences of the University of Virginia. Other data were obtained from that source, the official records of Virginia, the U. S. Bureau of the Census, and other official sources.

The data for the farm and urban properties included in the survey are presented in tables showing for each of the 10 districts into which the State was divided the index (1923=100) of tax rates on real estate and tangible property each year, 1924-1927; net rent and taxes per acre of farm real estate; total net rent and total taxes on urban real estate; value per acre of surveyed farms compared with the 1925 United States agricultural census values in the same counties and in all counties in the respective districts; percentage of crop land on the surveyed farms, on all farms in the same counties, and on all farms in the respective districts; relative percentage of net rent taken in taxes on the farm and urban real estate surveyed; relation of real estate taxes and of net rent to the value of farm and urban real estate; and percentage distribution of rented farms and town properties to the percentage of net rent paid in taxes. Other tables and graphs show comparisons for 1923-1927 of the value of crops and livestock per farm, per acre value of land, index of prices of farm products and of prices paid by farmers for commodities used in production and for hired labor, and the gross farm income per farm in Virginia; State and local taxes in Virginia, by years 1923-1926; estimated amount of different taxes paid by farmers, 1924; relation of real estate taxes to farm incomes in certain counties in certain years; comparative tax burden on rented farms in Virginia and other States; income and taxes of Virginia corporations of different kinds in 1925 and 1926; percentage distribution of farms included in the survey according to taxes and to net rent per acre; relation of net rent per acre to the percentage of such rent paid in taxes; distribution of rented farms and urban property included in the survey according to the percentage the assessed value is of the estimated true value; and variations in farm assessments in certain counties and in real estate assessments in certain towns and cities of the State.

The percentage of the net rent of the farms studied taken by real estate taxes varied from 15.9 to 32.8 in the 10 districts, averaging 20 per cent. Taxes on the urban properties studied varied from 10.3 to 23.3 per cent, averaging 16 per cent. State and local taxes on Virginia corporations in 1926 took 15.43 per cent of the net income. Real estate taxes and net rent in 1926 for the properties included in the survey were 0.78 and 3.9 per cent, respectively, of the value of the farm real estate, and 1.02 and 6.4 per cent, respectively, of the value of the urban real estate. Taxes took less than 5 per cent of the net rent in the case of 3.4 per cent of the farms and over 100 per cent in the case of 11.8 per cent of the farms. Taxes exceeded 50 per cent of the net rent on 21.7 per cent of the farms. For the urban properties, taxes were less than 5 per cent in the case of 3.4 per cent, over 100 per cent in the case of 1.3 per cent, and exceeded 50 per cent in the case of 3.7 per cent of the properties. Taxes took a larger proportion of net rent on the low rent farms than on the high rent farms. On an average, the farms included in the study were assessed at 34.5 per cent of their estimated true value and the urban properties at 40.5 per cent. Of the farms, 1.8 per cent were assessed at less than 10 per cent of their estimated true value, 4.1 per cent at over 100 per cent, and 75.5 per cent at 50 per cent or less. For the urban properties, the percentages were 4.6, 0.8, and 68.9 per cent, respectively. In 6 counties studied, 50 per cent of the farms were assessed at from only 39.9 to 59.5 per cent of the rate at which the other 50 per cent were assessed. In 4 cities the lower 50 per cent of the properties were assessed at from 41.1 to 56 per cent of the assessment of the upper 50 per

cent. In Richmond the lower 50 per cent were assessed at 86.2 per cent of the assessment of the upper 50 per cent.

Progress report on cost of production route in Jones County, Mississippi, 1928, L. E. LONG and J. R. ALLEN (*Mississippi Sta. Bul.* 269 (1929), pp. 30).—The data for the second year of the study previously noted (E. S. R., 60, p. 885) are tabulated, discussed, and compared with the results obtained for the previous year.

Factors affecting the cost of production of alfalfa hay in western Nevada, F. B. HEADLEY and R. M. CLAWSON (*Nevada Sta. Bul.* 117 (1929), pp. 45, figs. 14).—The records upon which this study, made in cooperation with the U. S. D. A. Bureau of Agricultural Economics, is based were kept by 26, 22, and 23 cooperating farmers in the years 1926, 1927, and 1928, respectively, in areas in the vicinities of Reno, Fernley, Lovelock, and Fallon, Nev. The records are analyzed and the results presented in tables and graphs showing the costs, by items, of producing alfalfa hay and of securing new stands of alfalfa; the effects of yield on cost and of season on yield and cost; monthly distribution of man labor in alfalfa production; man labor and horse work required for different operations; and the effect of yield on such requirements. A table of standard man labor and horse work requirements for farm operations necessary in producing alfalfa and charts for calculating cost of production of alfalfa under varying economic conditions are included.

The average cost of production per ton was \$6.90 at Fallon, \$7.87 at Fernley, and \$11.78 at Reno. The average net cost per acre of securing new stands of alfalfa was \$23.31 at Fallon and \$12.90 at Reno. The labor requirement was found to be proportional to the area in crop and averaged 26 hours per acre.

Cost of producing sheep on western Oregon farms, O. M. NELSON (*Oregon Sta. Circ.* 94 (1929), pp. 31, figs. 15).—This circular, which is based upon data obtained from the flock of the Oregon State Agricultural College and a few typical flocks in the Willamette Valley during a period of about ten years, discusses the various items entering into the costs of raising sheep and the returns from sheep raised for commercial spring lambs and for purebred rams. Tables are given showing by items the costs and returns for commercial farm sheep under different systems of management and of producing a grade yearling ewe, a purebred sheep to the age of six months, and a purebred yearling. Some data are included regarding sheep pastures of different kinds.

It was found that when wool is worth 35 cts. and lambs 10 cts. per pound farm ewes return \$10 per ton for hay, \$30 per ton for grain, 8 per cent on livestock investment, 40 cts. per hour for labor, and pasture rent. The average annual cost, including interest and depreciation, of running farm sheep is \$9.96 per head. The net cost of growing a yearling ewe from weaning to breeding age is \$3.90, making the total cost at breeding age \$11.40 when spring lambs are worth \$7.50 per head. The annual cost of running purebred ewes is about \$30 per head. Purebred lambs at weaning cost from \$17.50 to \$26 per head, depending upon the value of the breeding stock.

Corn or maize, T. O. MARVIN ET AL. (*Washington: U. S. Tariff Comm.*, 1929, pp. VII+91, pl. 1, figs. 4).—This is the report of October 22, 1928, and the supplemental report of August 1, 1929, of the U. S. Tariff Commission to the President of the United States on the differences in costs of production, and other advantages and disadvantages in competition, of corn or maize in the United States and the principal competing country, Argentina.

The information obtained in the Commission's investigation on the uses of corn, domestic production and imports, production in and exports from Argentina, prices in the two countries and Liverpool, farm costs of production in 1926

and 1927 in the United States by items of cost, total prices f. o. b. Buenos Aires and total c. i. f. prices at New York and Pacific coast ports, 1926 and 1927, marketing of domestic corn, competitive conditions, and transportation costs on corn imported into the United States is presented and discussed.

The commissioners were equally divided on the question whether New York City or the "Atlantic and Pacific seaboard" should be recognized as "the principal competing market." The first group found no change in the present duty on corn to be warranted, while the second recommended an increase to 225 cts. per bushel of 56 lbs.

Linseed oil, T. O. MARVIN ET AL. (*Washington: U. S. Tariff Comm., 1929, pp. IX+66, figs. 3*).—This is a report of the U. S. Tariff Commission to the President of the United States on an investigation of the differences in costs of production, and other advantages and disadvantages in competition, of linseed oil in the United States and the Netherlands, the principal competing country.

Included are data regarding the production of flaxseed; manufacture of linseed oil; production of and trade in linseed oil in the United Kingdom, the Netherlands, and Germany; imports, exports, and consumption of linseed oil in the United States; prices of flaxseed and linseed oil, cake, and meal; costs of production of linseed oil in the United States, the United Kingdom, and the Netherlands; and the marketing and transportation of domestic and imported linseed oil.

The statements of the commissioners as to the methods used and findings and the proclamation of the President, June 25, 1929, increasing the duty on linseed or flaxseed oil, raw, boiled, or oxidized, from 3.3 cts per pound to 3.7 cts are given.

The prune industry in Yugoslavia, M. J. NEWHOUSE (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 43 (1929), pp. [21]+34, pl. 1*).—This is a preliminary report in mimeographed form describing the origin, development, cultural aspects, and present status of prune production, and the harvesting, drying, local handling, grading, packing, and marketing of prunes in Yugoslavia. The procedure, extent, and problems of exporting prunes from Yugoslavia are discussed.

Quality as a determinant of vegetable prices, F. V. WAUGH (*New York: Columbia Univ. Press; London: P. S. King & Son, 1929, pp. 154, figs. 11*).—This is a study made by multiple correlation methods of the relationship between certain quality factors of native asparagus, outdoor tomatoes, and hothouse cucumbers and prices on the Boston wholesale market. Analyses were made of the records of quality and prices of 200 lots of asparagus between May 6 and July 2, 1927; 370 lots of tomatoes between May 19 and November 10, 1926; and 49 lots of cucumbers between May 5 and October 16, 1925. Samples of the lots were taken and rated for the qualities being considered and records obtained of the prices at which the lots sold. In making the analyses the percentage price (the percentage the price of the lot was of the top quotation for the day) was used as the dependent variable rather than the actual price received.

For asparagus, the independent variables were length of green color measured in inches, number of stalks per bunch, and variation in size within the bunch (the quartile coefficient of dispersion). The coefficient of multiple correlation was 0.75838 (corrected for number of observations and for number of independent factors, 0.737). The coefficients of regression indicated that each additional one-hundredth of an inch of green color was associated with an increase of 0.13826 in the percentage price, each additional stalk per bunch with a decrease of 1.53394, and each additional unit of variation in size in the bunch

with a decrease of 0.27553. The coefficients of determination showed that variation in green color accounts for 41 per cent of the squared variation in the percentage prices, variation in number of stalks per bunch for 14 per cent, and variations in the coefficient of dispersion in size for 2 per cent. The standard error of estimate was 21.253.

For tomatoes, the independent variables and the coefficients of regression were as follows: Trend (day in the study) -0.03703, day of week -2.45792, place grown -0.29004, pack +9.13307, percentage color +0.63228, percentage 1 to 2 in. -0.02518, percentage 2 to 3 in. -0.19791, percentage 4 to 5 in. -0.00046, variation -0.04630, percentage very soft -0.44466, percentage soft -0.24718, percentage firm +0.43782, and percentage growth cracks -0.52413. The coefficient of correlation was 0.6941 (corrected for number of observations and for number of independent factors, 0.680). The standard error of estimate was 31.9. The coefficients of determination indicated that 48 per cent of the squared variation in the percentage prices could be attributed to the 13 factors studied. Condition (percentage very soft, percentage soft, and percentage firm) accounted for 30 per cent, growth cracks 7 per cent, pack 5 per cent, size (3 factors) 2 per cent, and color 2 per cent. Separate analyses were made of the relationship of the price percentages for the different days of the week to the percentage of color, percentage of large size (3 to 4 in.), and percentage firm. The coefficients of correlation were for Mondays 0.575, Tuesdays 0.693, Wednesdays 0.880, Thursdays 0.890, Fridays 0.744, and Saturdays 0.720. The coefficients of determination indicated that of the squared variation in percentage prices, firmness accounted for 73 per cent on Thursdays, 40 per cent on Tuesdays, 38 per cent on Saturdays, 30 per cent on Mondays, 29 per cent on Fridays, and 7 per cent on Wednesdays.

For cucumbers, the independent variables were length and the ratio of diameter to length. The coefficient of multiple correlation and the standard error of estimate by straight line correlation were 0.577 and 23.67, respectively, and by curvilinear correlation 0.764 and 22.2, respectively. The coefficients of regression indicated that each additional inch in length was associated with an average increase of 4.937 in the percentage prices and one unit increase in the diameter length ratio with 1.99 decrease in the percentage prices. The coefficients of determination indicated that about 11 per cent of the squared variation in the percentage prices could be attributed to variation in length and about 22 per cent to the relation between diameter and length.

The need for information as to the effects of quality factors on prices; the application of the results of the present study to production and marketing practices of Massachusetts market gardeners, to grade requirements, and to market reports; and the advantages and disadvantages of the survey method and of statistical analysis in measuring the effects of quality factors are discussed. The influence of the several factors on price percentages are also given in terms of cents for the periods studied.

The disparity between wheat prices in Canada and in the United States and the grain storage situation (*U. S. Dept. Agr., Bur. Agr. Econ., 1929, pp. [1]+22, pls. 7*).—This mimeographed report presents the results of an investigation made in response to a request of the Federal Farm Board. The relation between wheat prices at country points in the United States and Canada and between prices at Winnipeg and Minneapolis and Duluth, and the grain storage situation at country points in the spring wheat area, July 31 to September 21, 1929, and at terminals, July 1 to November 1, 1929, are analyzed and discussed.

The disparity in Canadian and United States prices during the summer and fall of 1929 was found to be due primarily to a congestion at terminal markets

in the United States. Large stocks of old wheat on hand in terminal elevators, slowness of export demand, rather heavy movement of old wheat to terminals just before the movement of the new crop started, and early and heavy movement of the new crop were the chief factors causing the congestion in the terminal elevators. The congestion, it is estimated, cost United States producers who sold their wheat between the middle of July and the first of October on an average about 10 cts. per bushel.

The farm export debenture plan, J. S. DAVIS (*Food Research Inst. [Stanford Univ.] Misc. Pub. 5* (1929), pp. X+274).—This volume is primarily an exposition and analysis of the export debenture plan, with special reference to the Ketcham bills of 1928 (Seventieth Congress, H. R. 10568 and 12892) and to the McNary bill of April 23, 1929 (Seventy-first Congress, S. 1). The subject is discussed under the following chapter headings: Essential features of the plan, the case for the plan, sources of support for the plan, the prospective cost of the plan, reflection back to farm prices—the case of wheat, the question of stimulus to production of wheat, the plan as applied to other commodities, the bearing of foreign experience, potential reactions of foreign governments, and concluding considerations.

Potato outlook charts, with explanations (U. S. Dept. Agr., Bur. Agr. Econ., 1929, pp. [47], figs. 23).—Twenty-three charts, with explanations, are included showing the potato acreage and commercial production, 1924; acreage, yield per acre, and production, 1869–1929; acreage in regional groups of States; factors affecting acreage; States producing late potatoes in excess of 3 bu. per capita in 1923 and State price, December 1, 1923; farm prices of potatoes and index of retail prices of commodities farmers buy, 1910–1929; production and farm price, 1921–1929; production and prices to growers of early and second early potatoes, 1921–1929; relation between price received by producers and subsequent changes in New York acreage, 1920–1928; weekly summaries of carload shipments by areas, 1923–1925, and by States, 1922–1924; destinations of Florida, South Carolina, North Carolina, Eastern Shore, Kaw Valley and Orrick section, western New York, Maine. Red River Valley, Michigan, Idaho, and Colorado shipments; and sources of unloads at New York, Chicago, Los Angeles, and Birmingham.

Market supplies and prices of apples, J. W. PARK (*U. S. Dept. Agr. Circ. 91* (1929), pp. 92, figs. 11).—This circular, which is a part of an economic study of the apple industry of the United States being made in cooperation with various State agencies, describes and discusses the sources of apple supplies, methods and time of shipment, storage, transportation charges, competition among varieties in different cities and different sections of the United States, distribution, retailing practices, and the effect on prices of supply, varieties, grade, size, season, container, origin of supply, and the prices in different markets.

Pages 31 to 91 include tables.

Pacific coast pear supply and price situation, S. W. SHEAR (*California Sta., 1929, pp. 9, figs. 8*).—This mimeographed article is an address presented at the Western Pear Meet, held at Medford, Oreg., November 13, 1929, and supplements Bulletin 452 previously noted (*E. S. R.*, 59, p. 485).

Foreign trade of the United States, annual, 1790–1929: Hogs, pork, and pork products, C. G. GILES (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 44* (1929), pp. [11]+65, pl. 1).—This mimeographed set of tables shows the annual exports, imports, reexports, net balance, quantity, and value of hogs, pork, and pork products, 1790–1929. Tables are included as follows: Live hogs, bacon, hams and shoulders, Wiltshire and Cumberland sides, salted and other cured pork, lard and neutral lard, and total pork and pork products, 1790–1929; shipments of hogs, pork, and pork products from the United States

to Alaska, Hawaii, and Porto Rico, 1903-1929; inspected hogs—imports, quarantined and not quarantined, 1891-1929; live hogs—imports, inspected and classified according to purpose for which imported, 1928-29; canned pork, 1900-1929; fresh pork, 1872-1929; lard compounds, 1893-1929; sausage and sausage casings, 1869-1929; and lard oil, 1855-1929.

Foreign trade of the United States, annual, 1790-1929: Cattle, beef, and beef products, C. G. GILES (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 45* (1929), pp. [1]+71, pls. 2).—This is a mimeographed set of tables showing the annual exports, imports, reexports, net balance, quantity, and value of cattle, beef, and beef products, 1790-1929. Tables are included as follows: Live cattle, salted, pickled, and other cured beef, tallow, and total beef and beef products, 1790-1929; shipments of cattle, beef, and beef products from the United States to Alaska, Hawaii, and Porto Rico, 1903-1929; inspected cattle—imports, quarantined and not quarantined, 1891-1929; live cattle—imports, inspected and classified according to purpose for which imported, 1928-29; canned beef and stearin, 1864-1929; oleo oil, 1876-1929; oleomargarine, 1882-1929; oleo stock, 1922-1929; sausage and sausage casings, 1869-1929; and fresh beef and veal, 1872-1929.

How great cities are fed, W. P. HEDDEN (*Boston and London: D. C. Heath & Co., 1929*, pp. XVI+302, figs. 63).—The chapters of this volume "trace the revolutionary changes in methods of distributing perishable foodstuffs to our large terminal centers, analyze the types of facilities needed under the new conditions, emphasize the more important elements of city marketing cost, and point out the developments which seem to promise a reduction in the spread between farm and city prices."

Credit in the purchase of farm supplies in Ohio, C. G. McBRIDE and B. A. WALLACE (*Ohio State Univ., Dept. Rural Econ. Mimeogr. Bul. 12* (1928), pp. [2]+51, figs. 11).—This is a mimeographed report of a study of the credit operations of 21 companies operating 28 elevators in 15 counties and of farm bureau service companies in 21 counties. The data are analyzed under the headings of amount of credit business, length of time charges remain on the books, seasonal variation of credit business, cost of credit, and the methods of credit operation and rates of interest charged. The credit situation in the two types of organizations and the farmer as a credit risk are discussed.

Organization and management problems of cooperative oil associations in Minnesota, R. K. FROKER and H. B. PRICE (*U. S. Dept. Agr. Circ. 80* (1929), pp. 47, figs. 12).—The distribution, financial organization, management, buying policies, price policies, distribution of sales and savings, gross income and savings, cost of operation, and the federation of cooperative oil associations in Minnesota are described and discussed. Appendixes include suggested forms for annual statements, suggestions for organizing an association, and suggested articles of incorporation and by-laws. A brief description of cooperative oil associations in Illinois is also given.

The study was made in cooperation with the University of Minnesota and is based chiefly on data gathered in 1926 through personal visits and later in 1928 supported and enlarged from annual statements and audits collected from accountants and association records.

[**Papers and proceedings of the American Sociological Society, 1928**] (*Amer. Sociol. Soc. Pubs., 23* (1929), pp. VIII+416, pls. 3, figs. 9).—This volume, entitled *The Rural Community*, includes the proceedings of and papers read at the twenty-third annual meeting of the society, held December 26-29, 1928.

The papers and abstracts of papers bearing directly on rural sociology were as follows: *Urban Influence and Selection*, by J. M. Gillette (pp. 1-14); *An*

Appraisal of the Community Movement, by J. F. Steiner (pp. 15-29); Type of Agriculture as a Conditioning Factor in Community Organization, by C. E. Lively (pp. 35-50); Cotton Culture and Social Life and Institutions of the South, by R. B. Vance (pp. 51-59); Age and Sex Distribution in Relation to Rural Behavior, by B. L. Melvin (pp. 93-103); Selective Rural-Urban Migration, by C. C. Zimmerman (pp. 104-115); A Farm Welfare Statistical Program, by J. O. Rankin (pp. 116-123); Family Life and Rural Organization, by J. H. Kolb (pp. 146-152); Farmers' Movements as Psychosocial Phenomena, by C. C. Taylor (pp. 153-162); Studies in Rural Leadership, by D. Sanderson and R. W. Nafe (pp. 163-175); The Case Study of the Farm Family as a Method of Rural Research, by E. L. Kirkpatrick (pp. 176-179); Research Methods in Social Organization: A Case-Study in Method, by H. J. Burt (pp. 214-222); Rural-Urban Differences in Religious Culture, Beliefs, and Behavior, by P. A. Sorokin (pp. 223-238); Population Projects, by C. L. Fry (pp. 239-247); The Life-Study Method as Applied to Rural Social Research, by C. H. Cooley (pp. 248-254); Influence of Formal Schooling on Consumptive Tendencies in Two Rural Communities, by L. Nelson and N. I. Butt (pp. 255-260); The Attitude of Farmers toward the County Farm Bureau, by W. R. Tylor (pp. 261-273); Methods of Studying Personality Development in Rural and Urban Groups, by H. B. Hawthorn (pp. 274-283); The Present Content of the Introductory Course in Rural Sociology, by F. R. Yoder (pp. 287-295); What the Content of the Introductory Course in Rural Sociology Should Be, by N. L. Sims (pp. 296-300); Use of Surveys, Census Data, and Other Sources, by J. O. Rankin (pp. 301-305); Rural Community Organization in Ohio—a Specific Illustration, by C. E. Lively (pp. 311-313); The Use of the Score Card in a West Virginia Community, by A. H. Rapkin (pp. 314, 315); Abstract of a Study by Manuel Gamio, Mexico, of the Antecedents of Mexican Immigration into the United States, by R. Redfield (p. 316); Economic Reasons for the Coming of the Mexican Immigrant, by M. S. Handman (p. 317); Mexican Immigration from the Sociological Point of View, by E. S. Bogardus (p. 317); Problems of Rural Education Demanding Sociological Research, by D. H. Kulp II (p. 319); and Implications of Recent Rural Surveys for the Rural School, by E. DeS. Brunner (p. 320). Discussions of some of the papers or groups of papers are also included. Some of the papers have been referred to editorially (E. S. R., 60, p. 307).

Research in the social sciences, edited by W. GEE (*New York: Macmillan Co., 1929, pp. X+305, figs. 4*).—This volume includes lectures delivered at a meeting of the Institute for Research in the Social Sciences of the University of Virginia in 1926 on the fundamental objectives and methods of research in different social sciences as follows: Sociology, by R. E. Park (pp. 1-49); Economics, by A. A. Young (pp. 51-80) Anthropology, by C. Wissler (pp. 81-111); Statistics, by R. E. Chaddock (pp. 113-147); Psychology, by R. S. Woodworth (pp. 149-177); Jurisprudence, by R. Pound (pp. 179-206); History, by A. M. Schlesinger (pp. 207-237); Philosophy, by J. Dewey (pp. 239-265); and Political Science, by C. A. Beard (pp. 267-291).

Report of the commission to study the condition of the farmers of Virginia to the General Assembly of Virginia, January, 1930, J. A. BURSUS ET AL. (*Richmond: State, 1930, pp. 133, figs. 4*).—This commission was created by act of the general assembly of 1928 to make "a careful study of the general condition of all of the agricultural interests in the State; the efforts and expenditures made for general agricultural advancement, for the standardization and sale of all kinds of farm crops and products, for the improvement and marketing of livestock; and all other matters affecting the general economic condition of the farmer."

Recommendations are made and supporting material given on standards of living, marketing and farm management, regulation and inspection, transportation, food production and consumption, land utilization and forestry, rural electrification and engineering, taxation, relations to industry, correlation of agencies, and national relationships. An appendix includes a digest of the laws pertaining to forest taxation in the several States of the United States, resolutions of the Southern Forestry Congress, 1929, concerning taxation of forest lands, and the report of the joint committee on rural electrification appointed by the Governor of Virginia.

Rural and urban living standards in Virginia, W. GEE and W. H. STAUFFER (*Va. Univ., Inst. Research in Social Sci., Inst. Monog. 6 (1929), pp. X+133, figs. 2*).—This monograph of the Institute for Research in the Social Sciences, University of Virginia, presents an analysis of schedules gathered from September, 1928, to March, 1929, from 137 farm families in Culpeper and Bedford Counties and from 140 families in Lynchburg, a city with an estimated population (1926) of 38,500 people. Both the county and city samples were selected according to three fairly well defined classes, poor, intermediate, and prosperous, rather than from selected representative areas, and the data from the two types of communities are considered comparatively.

In the rural sample there were 40 "poor" families, the average expenditure of which was \$892.03, no family having an expenditure as high as \$1,200; 85 "intermediate" families with total expenditures ranging from \$1,200 to \$2,500 and averaging \$1,722.56; and 12 "prosperous" families with expenditures ranging from \$3,000 to \$6,262 and averaging \$4,084.30. The number of families, range of expenditures, and average expenditures for the three classes in the urban sample were for poor 35, below \$1,400, and \$976.80; intermediate 78, from \$1,400 to \$2,800, and \$1,958.60; and prosperous 27, from \$3,000 to \$18,500, and \$6,770.79, respectively.

Tables are given and discussed for the classes in the rural sample showing (1) the expenditures for food, clothing, rent, household operating expenses, household furnishings and equipment, health, personal expenses, advancement and recreation, and life and health insurance; (2) the percentage that the expenditures for each item were of the total expenditures; and (3) comparative data for 2,886 white farm families in 11 other States arranged from the study previously noted (*E. S. R.*, 56, p. 185). Other tables show for the three classes in the city sample the expenditures for the different purposes, the percentage of each of these expenditures of the total expenditures, and a comparison with the expenditures for the rural sample.

The social and environmental factors—number of children per family, educational attainments, occupational status of children, environment, and cultural and recreational activities—affecting the standards of living in the three groups of each sample are discussed.

An article on nutritive value of foods consumed by city and farm families in Virginia, by E. Hawley of the Bureau of Home Economics, U. S. D. A., is also included.

Fort Lewis: A community in transition, F. N. HOUSE, F. W. HOFFER, R. H. BARKER, and C. C. RODEFFER (*Va. Univ., Inst. Research in Social Sci., Inst. Monog. 7 (1930), pp. [7]+56, pls. 6*).—This is the report of a study made by the Community League of Fort Lewis, Roanoke County, Va., under the auspices of the Cooperative Educational Association of Virginia and in cooperation with the School of Sociology of the University of Virginia of a rural community formerly more or less independent but now tending to become an outlying suburb or residential district of the city of Roanoke.

The study was an experiment in the method of making such studies, being "undertaken largely for the sake of finding out what could be done in the way of a comprehensive study of a local community on the basis of data collected entirely, or almost entirely, by unpaid volunteers—residents of the community." The schedules used were prepared by a committee appointed by the Cooperative Educational Association. The data were tabulated and analyzed in the School of Sociology of the University of Virginia. The value of the method as shown by the results obtained is discussed.

Small towns: An estimate of their trade and culture, W. BURE (New York: Macmillan Co., 1929, pp. X+267).—This is a description and discussion of the rural community in the United States based on 15 years' study, with field observation and experience particularly in the Middle West.

A statistical study of Virginia, W. GEE and J. J. CORSON, 3d (Va. Univ., *Inst. Research in Social Sci., Inst. Monog. 1* (1927), pp. 201, figs. 18).—The tables and charts included in this monograph of the Institute for Research in the Social Sciences, University of Virginia, cover area and population, health, social statistics, education, agriculture, manufacturing and mining, banking and insurance, taxation and cost of government indebtedness and wealth, and miscellaneous data for Virginia and other States of the United States and the different counties of Virginia. The data under each heading are briefly summarized.

Terminology and bases for an international agricultural statistic founded upon farm accounting, E. LAUR (*Terminologie et Fondements d'une Statistique Internationale Basée sur la Comptabilité Agricole*. Brugg, Switz.: Effingerhof, 1929, pp. 51+[1]).—This is a report (in French, German, and English) presented to and adopted by the International Congress of Agriculture at Bucharest, 1929. The following terms are defined and the methods of computing are described: Net return on total farm assets (net return), taxable net return, gross return, farm expenses, cost of production, profit or loss on total farm assets, family farm earnings, family labor earnings, family capital return (return on own capital), operator's profit or loss, social income, and interest return on landlord's capital.

The author states that net return on total farm assets is the most appropriate standard for measuring the success of farming, and that the correct calculation of it is dependent upon an accurate computation of gross return and of farm expenses. He distinguishes farm expenses from cost of production. A list of some of the main terms used in farm accounting is also included.

International yearbook of agricultural statistics, 1928-29 (*Internatl. Inst. Agr. [Rome], Internatl. Yearbook Agr. Statis., 1928-29, pp. XXVIII+581*).—This is a continuation of the series previously noted (E. S. R., 61, p. 289).

FOODS—HUMAN NUTRITION

The protein intake of medical students, F. P. BROOKS (*Amer. Jour. Physiol.*, 89 (1929), No. 2, pp. 403-405).—This further contribution to the knowledge of the protein consumption of male medical students was occasioned by the reports of Denis and Borgstrom (E. S. R., 52, p. 761) and Beard (E. S. R., 58, p. 492). A study of 817 24-hour urine samples from 192 male medical students at Chapel Hill, N. C., over a period of six years, with a temperature range of +5 to 6.9° C., gave the following results:

The minimum, maximum, and average values for nitrogen excretion in the urine were 5.42, 18.43, and 10.34 gm. per 24 hours. The average excretion corresponds to a protein consumption of 71.3 gm. per 70 kg. body weight after adding 10 per cent for protein lost in the feces. This is in close agreement

with the values reported by Denis and Borgstrom for warmer and Beard for colder climates, and confirms the conclusion of the latter that protein habits are little affected by change of temperature within this range of climate and in this occupation.

Should whole wheat products displace the refined products? V. E. LEVINE (*Arch. Ped.*, 46 (1929), No. 5, pp. 281-296).—Arguments are advanced with references to the literature in support of the value of whole wheat flour as a corrective for deficiencies in iron, vitamin B, and vitamin E, and for constipation.

A bibliography of 52 titles is appended.

Rice and beans as an adequate diet, D. H. COOK and T. RIVERA (*Porto Rico Jour. Pub. Health and Trop. Med.*, 5 (1929), No. 1, pp. 16-20, fig. 1).—By the customary feeding experiments with white rats, the authors have demonstrated the inadequacy of a diet of boiled rice and beans, the customary diet of the country people of Porto Rico. The first limiting factor in the diet appeared to be vitamin D and the next vitamin A. Exposure to sunlight improved the growth rate of the rats to a greater extent than supplementing the diet with yautia, yellow or white, or with the ripe or green plátano (plantains) (E. S. R., 59, p. 793).

Studies on the nutritive value of milk.—III, The supplementary value of various constituents of synthetic basal rations, W. E. KRAUSS (*Jour. Dairy Sci.*, 12 (1929), No. 6, pp. 438-444).—Continuing the investigation previously noted (E. S. R., 61, p. 490), the author has tested the value, as a preventive of nutritional anemia in rats fed an exclusive whole milk diet, of the various constituents of ordinary synthetic rations. The materials tested, each of which constituted the only supplement to the whole milk for a group of 2 male and 2 female rats caged together, were as follows: Dried yeast 0.4 gm., cod-liver oil 3 drops, McCollum's salt mixture 185 0.25 gm., gelatin 0.25, agar 0.5, casein 2, starch 2, rice polishings 0.4 gm., and wheat germ oil 3 drops per rat per day, and irradiated milk ad libitum.

Of these substances yeast, McCollum's salt mixture, agar, casein, and starch were effective and the others ineffective in preventing anemia. Analyses for iron and copper of the materials found effective indicated a rather definite relationship between the amounts of the two elements. The hemoglobin levels of the rats were highest when at least 0.45 mg. of iron and 0.04 of copper were furnished per rat per day. These figures correspond closely with those reported to be effective by Hart et al. (E. S. R., 59, p. 893).

Equally good results with the ash of yeast as with the original yeast showed that no organic factor was involved. Negative results with rice polishings, cod-liver oil, irradiated milk, and wheat germ oil excluded vitamins B, A, D, and E as having any effect upon hemoglobin production.

Attention is called to the common use of yeast, casein, agar, starch, and McCollum's salt mixture in synthetic basal rations and to the necessity in the use of a basal ration containing any of these ingredients in iron metabolism or hemoglobin regeneration studies of carefully evaluating both the copper and iron content of the ration. Attention is also called to wide variations in the antianemic potency of different samples of yeast.

It is concluded that "an exclusive whole milk diet fed ad libitum to rats furnishes adequate protein, energy, and vitamins for growth, but is deficient in copper and iron."

Evaporated milk and its relation to public health, F. E. RICE (*Amer. Jour. Pub. Health*, 19 (1929), No. 7, pp. 777-783).—A discussion of the value of evaporated milk from the standpoint of safety, economy, and nutritive properties.

A soy bean food preparation for feeding infants with milk idiosyncrasy. L. W. HILL and H. C. STUART (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 13, pp. 985-987).—A dried soybean preparation which has given excellent results as a temporary diet for infants suffering from eczema as the result of sensitiveness to milk proteins is described, with proximate and mineral analyses and dosage.

The Mineral content of the jujube. M. P. BENOX (*Jour. Agr. Research [U. S.]*, 39 (1929), No. 12, pp. 949-951).—Mineral analyses are reported from the Oklahoma Experiment Station for two samples of the sun-dried fruit of the jujube or Chinese date (*Zizyphus jujuba*) collected in the fall of 1928 from two trees grown in the orchards of the station. For purposes of comparison similar analyses were made of standard brands of dates and seeded raisins. The Official methods of analysis were used, except that potassium was weighed as perchlorate and that an adaptation of the Kennedy method² was used with iron. The data are reported in terms of percentage of ash and individual mineral constituents on a moisture-free basis and percentage composition of the ash. The former values for the two varieties of the jujubes were as follows: Ash in edible material 1.84 and 2.36, CaO 0.100 and 0.132, MgO 0.083 and 0.083, K₂O 1.056 and 1.318, Na₂O 0.031 and 0.033, P₂O₅ 0.019 and 0.015, MnO 0.021 and 0.023, Fe₂O₃ 0.0021 and 0.0027, SO₂ 0.034 and 0.033, Cl 0.076 and 0.036, and SiO₂ 0.005 and 0.006. Considering the minerals of nutritional significance, the two varieties of jujubes compared favorably with dates and raisins with respect to phosphorus and calcium and were markedly inferior in iron content. In terms of percentage composition of the ash, the values for CaO were dates 6.63, seeded raisins 2.64, and jujubes 5.42 and 5.60 per cent, respectively. Corresponding figures for P₂O₅ were 0.78, 1.06, 1.04, and 0.64 per cent and for Fe₂O₃ 0.471, 0.576, 0.115, and 0.115 per cent, respectively.

Composition of Philippine coffee. A. VALENZUELA (*Philippine Jour. Sci.*, 40 (1929), No. 3, pp. 349-351).—Proximate analyses are given of seven varieties of Philippine raw coffee and the average values compared with reported averages for foreign raw coffee. According to these values the Philippine coffee has a somewhat higher content of caffeine and a lower of fat and reducing sugars than foreign coffees.

The problem of sweets for children. H. C. SHERMAN ET AL. (*Amer. Jour. Pub. Health*, 19 (1929), No. 11, pp. 1205-1209).—This annual report of the committee on nutritional problems of the American Public Health Association (E. S. R., 62, p. 97) deals with the claims now being made in behalf of a larger use of sweets as food not only for adults but even for children. The nutritional significance of each of the different types of food materials which make up the bulk of the food budget is discussed briefly. It is pointed out that breadstuffs and other grain products make up the largest and cheapest source of calories and protein, but are not satisfactory sources of the mineral elements and vitamins; that the meat foods are rich either in protein and fat or both, but show the same mineral and vitamin deficiencies as do the grains; that fruits and vegetables are important sources of some of the mineral elements and vitamins; that milk is the most efficient and almost always the most economical of all foods in making good the mineral and vitamin deficiencies of the breadstuffs; that eggs stand midway between milk and meat in their nutritional properties; that fats constitute a concentrated source of calories and in some cases of fat-soluble vitamins; and, finally, that sugar contributes nothing of food value except as a source of calories.

² The Quantitative Determination of Iron in Tissues. R. P. Kennedy, *Jour. Biol. Chem.*, 74 (1927), No. 2, pp. 385-391, fig. 1.

In the opinion of the committee "it may be said that in general the proper place of sugar in the food supplies and eating habits of children is not in such concentrated forms as candy, nor in the indiscriminate and excessive sweetening of all kinds of foods, but rather as a preservative and flavor to facilitate the introduction into the child's dietary of larger amounts of the fruit and the milk, the importance of which to child health has been increasingly emphasized with each year's progress in our knowledge of nutrition."

What place have aluminum, copper, manganese, and zinc in normal nutrition? [M. S. Rose] (*Jour. Nutrition*, 1 (1929), No. 6, pp. 541-556).—A critical review of recent literature on the subject, with an extensive bibliography.

Studies in the metabolism of aluminium, II-VIII (*Amer. Jour. Physiol.*, 90 (1929), No. 1, pp. 15-82).—This extensive investigation of aluminum metabolism was undertaken in 1922 "with the conviction that the methods then published for the estimation of aluminum were so crude and inaccurate that the conclusions drawn are open to serious criticism."

II. *Absorption and deposition of aluminium in the dog*, F. P. Underhill and F. I. Peterman (pp. 15-39).—Using the method described on page 503, the authors have determined the aluminum content of the blood of dogs in starvation and following various additions of aluminum to the diet in the form of biscuits made with straight alum and alum-phosphate baking powders. Evidence of aluminum was found in the blood and tissues of normal fasting dogs and in slightly larger amounts in dogs on a diet to which no aluminum had been added. Following a single feeding of food to which aluminum had been added, evidence was obtained that the aluminum was promptly absorbed and continued to be absorbed with continued feeding. After prolonged feeding there was a decrease in the absorption accompanied by a decrease in storage and excretion. The absorbed aluminum circulated in the blood and was stored especially in the liver, brain, kidney, spleen, and thyroid and excreted chiefly through the bile.

III. *Absorption and excretion of aluminium in normal man*, F. P. Underhill and F. I. Peterman (pp. 40-51).—Similar experiments with human subjects, students at Yale University School of Medicine, gave variable results for the content of aluminum in the blood of fasting subjects, the amounts ranging from 0 to 0.21 mg. per 100 cc. The content in the blood of the same subjects also varied within narrow limits from time to time. Similarly the ingestion of an aluminum-rich food was followed in some cases, but not in others, by definite increases in the aluminum content of the blood. In control subjects on food presumably low in aluminum, there was usually a decrease in the aluminum content of the blood. The urine also showed the presence of aluminum in some but not all cases. Although there was a tendency for the aluminum in the urine to increase after the ingestion of aluminum-rich foods, the total urinary excretion never exceeded 0.5 mg. per 24 hours.

IV. *The fate of intravenously injected aluminium*, F. P. Underhill, F. I. Peterman, and S. L. Steel (pp. 51-61).—In this study an attempt was made to determine the effect upon dogs of a sudden increase in the aluminum content of the blood brought about by the intravenous injection of aluminum sulfate or chloride in amounts slightly greater than the largest amount found in the blood after feeding aluminum-rich food.

Three series of experiments were conducted. In the first, the blood, urine, and bile of 2 dogs were analyzed for aluminum at short intervals after the intravenous injection of an aluminum chloride solution in amounts furnishing 2 mg. of aluminum per kilogram of body weight. In the second, the blood, lymph, and urine were examined after the injection of the aluminum salt, and

for comparison the blood and lymph of dogs receiving alum by ingestion were examined. In the third series, determinations were made of the aluminum content of the stomach, small intestines, and large intestines following the intravenous injection of the aluminum salt.

The aluminum appeared in the bile, lymph, and urine within a few minutes after the injection, while the aluminum content of the blood decreased. The amount appearing in the other fluids was not always enough to account for that disappearing from the blood during the same interval. This is thought to point to a storage of aluminum in the tissues. In a single dog fed large amounts of aluminum in the form of alum-phosphate biscuits, evidence was obtained of absorption of aluminum from the gastrointestinal tract and by the lymph rather than the blood. The analyses of the stomach and intestines showed that the injected aluminum was eliminated in part through all portions of the digestive tract. There was no evidence that the phosphorus excretion through the intestinal walls was increased by the presence of aluminum.

V. *The relation of age to the amount of aluminium in tissues of dogs*, F. P. Underhill and F. I. Peterman (pp. 62-66).—Analyses for aluminum of various organs of dogs showed little or no aluminum in the embryo stage, detectable amounts in the tissues of puppies, particularly in the lungs, and much larger amounts in old dogs.

VI. *The occurrence of aluminium in human liver and kidney*, F. P. Underhill, F. I. Peterman, E. G. Gross, and A. C. Krause (pp. 67-71).—Data on the aluminum content of 22 livers and 21 kidneys from human autopsy material are reported and discussed. The range for the liver was from 0.17 to 1.17 mg. per 100 gm. and for the kidney from 0.13 to 0.87 mg. As was the case with dogs, the data showed an increasing content of aluminum with increasing age. When grouped by locality, consistently higher results at corresponding ages were noted in certain localities than in others, material from Michigan being consistently higher than from Connecticut. "These differences are probably not accidental, and could conceivably be traced to some factor in the environment, such as diet, water supply, or type of soil."

VII. *The aluminium content of some fresh foods*, F. P. Underhill, F. I. Peterman, E. G. Gross, and A. C. Krause (pp. 72-75).—Data obtained by the method described in the first paper are reported on the aluminum content of several foods of vegetable and animal origin. The average results expressed as milligrams per 100 gm. are as follows: Apples, 0.047 mg.; string beans, 0.63; beef, 0.5; beets, 0.48; cantaloupe, 0.77; cherries, 3.49; sweet corn, 0.26; eggs, 0.017; flour, 1.69; head lettuce, 1.18; calf liver, 1.73; pork liver, 1.77; mutton, 0.43; milk, 1.54; onions, 4.31; oranges, 0.088; peaches, 0.88; peas, 0.31; pork, 0.44; potatoes, 0.97; and watermelon, 0.028 mg. Attention is called particularly to the relatively high content in cherries, this being true for both sweet and sour cherries from California and Connecticut, respectively.

VIII. *A note on the toxic effects produced by subcutaneous injection of aluminium salts*, F. P. Underhill, F. I. Peterman, and A. Sperandeo (pp. 76-82).—The final paper of the series deals with the toxic effects produced in healthy rats, guinea pigs, and rabbits by the subcutaneous injection of 20 per cent solutions of aluminum sulfate and chloride. Rats were given a single injection and guinea pigs and rabbits divided doses, beginning with from 3 to 5 gm. per kilogram and followed by 1 gm. on alternate days. The symptoms produced in the three species were similar. No symptoms were noted with small doses, but large doses were followed after a few hours by loss of appetite, inactivity, and depression. The lethal doses varied from 5 to 8 gm. per kilogram and caused death in from 2 to 11 days. Outstanding pathological results were injuries to the liver and kidney and probably also the spleen.

Some recent advances in vitamin and mineral research, H. S. MITCHELL (*West. Hosp. and Nurses' Rev.*, 13 (1929), No. 5, pp. 17-20, 64).—A review of recent literature on the subject, with a list of 34 references.

The diet of the young child, S. J. COWELL (*Pub. Health [London]*, 42 (1929), No. 10, pp. 344-350).—Factors to which, in the opinion of the author, most attention should be given in the diet of pregnant and lactating women and of infants and young children are the fat-soluble vitamins A and D and the mineral elements calcium and iron.

Vitamin A and carotene.—I, The association of vitamin A activity with carotene in the carrot root, T. MOORE (*Biochem. Jour.*, 23 (1929), No. 4, pp. 803-811, figs. 4).—Interest in the activity of apparently pure carotin as a source of vitamin A (E. S. R., 61, p. 793) has led to reinvestigation of the vitamin A content of fresh carrots and carrot fat, together with further studies on the vitamin A activity of carotin. Daily doses of 100 mg. of fresh carrot root proved sufficient to cure xerophthalmia in rats deprived of vitamin A, but provided with sufficient vitamin D. A sample of carrot fat from which much of the carotin had been removed was active in doses of 0.4 mg. daily, and purified carotin, melting point 174° C., in doses of 0.01 mg.

The report contains a critical review of recent literature on the relationship of vitamin A to carotinoids and a discussion of the divergent results reported in regard to the presence of vitamin A in carotin.

Acceleration of lipase activity by substances containing vitamin A, B. L. JOHNSON (*Iowa State Col. Jour. Sci.*, 2 (1928), No. 2, pp. 145-153).—Devising an appropriate method and studying several phases to eliminate possible sources of acceleration other than that due to vitamin A or similar concentrates, the author noted and investigated an acceleration of lipase activity associated with the presence of vitamin A concentrates with a view to correlating this acceleration with the vitamin A content of various fats and oils. Whereas concentrates from butterfat and cod-liver oil accelerated lipase activity, a concentrate from inactivated butterfat gave but very little acceleration. Concentrates from cottonseed oil and lard accelerated lipase activity. These were shown, however, to contain fatty acids which reacted with the medium to give soaps. Sodium oleate and sodium palmitate accelerated lipase activity. Vitamin A concentrates from butterfat and cod-liver oil were separated from their free fatty acid content and found to give measurable acceleration of lipase, while those from lard and cottonseed oil increased lipase activity irregularly.

"While there is no accurate parallelism between the lipase stimulating activity of the vitamin A concentrates and their antixerophthalmic effect upon rats, there is indication that vitamin A stimulates lipase activity. Further work is required to resolve this inconsistency of results."

Studies on the antineuritic vitamin.—Part III, Further evidence of the composite nature of B vitamin, J. L. ROSEDALE (*Indian Jour. Med. Research*, 17 (1929), No. 1, pp. 216-221).—In this continuation of the investigation noted previously (E. S. R., 61, p. 293), feeding tests conducted on rats and pigeons with the lead acetate precipitate obtained in the course of separating the antineuritic vitamin from rice polishings by the method noted in the first paper of the series have led to the conclusion that the fraction does not contain the antipellagic factor, but does contain a factor the absence of which leads to symptoms of stasis in the intestines and which, it is thought, may have some connection with wet beriberi.

On the carbon : nitrogen (C/N) ratio in the urine of rats deprived of one or both factors of the vitamin B complex, S. K. KON (*Jour. Nutrition*, 1 (1929), No. 6, pp. 467-473, fig. 1).—In the metabolism studies reported, the

general plan of Kon and Drummond (E. S. R., 58, p. 193) was followed for distinguishing between the effects of simple inanition and vitamin deficiency by using individual controls receiving a complete diet restricted in amounts to the quantities ingested day by day by mates on the deficient diet. Yeast was given as the source of vitamin B, a 90 per cent alcoholic extract of rice polishings for vitamin F, and autoclaved yeast for vitamin G.

It was found that rats kept on a diet deficient in vitamin G had an increased C/N ratio in the urine as compared with controls receiving equivalent amounts of the complete diet. The rats receiving autoclaved yeast showed no difference from the controls, and those receiving yeast only a slight difference. This is thought to indicate that the heat-stable factor of vitamin B is in some way linked with the metabolic processes of the body.

The vitamin-C content of fresh sauerkraut and sauerkraut juice. B. CLOW, A. L. MARLATT, W. H. PETERSON, and E. A. MARTIN (*Jour. Agr. Research* [U. S.], 39 (1929), No. 12, pp. 963-971, figs. 5).—This is a complete report of an investigation noted from a preliminary report (E. S. R., 61, p. 194). Fresh raw sauerkraut was fed to guinea pigs as the sole source of vitamin C at levels of 10, 5, and 2.5 gm. daily for approximately 60 days and sauerkraut juice at a level of 10 gm. for 75 days. Complete protection against scurvy and in some cases growth comparable to that of the controls on 5 gm. of raw cabbage were secured with 10 gm. of either fresh sauerkraut or juice. Protection and good growth were secured with 5 gm., and partial protection, but loss in weight, with 2.5 gm. of the fresh sauerkraut. The 2.5-gm. level of raw cabbage allowed good growth for from 44 to 58 days, after which the weight curves flattened, but there was no evidence of scurvy. In a few curative tests recovery was secured with 5 cc. of fresh sauerkraut juice daily.

The authors point out that no conclusions as to the probable vitamin C content of commercial sauerkraut are warranted from these studies. "Whether or not canned sauerkraut or commercial sauerkraut juice contains vitamin C can be decided only by carefully controlled experiments that deal directly with these products."

Constitution of a new artificial diet producing avitaminosis C and permitting the study of scurvy and researches on the antiscorbutic vitamin [trans. title], L. RANDOIN and R. LECOQ (*Jour. Pharm. et Chim.*, 8, ser., 10 (1929), No. 8, pp. 337-344, fig. 1).—Essentially noted from another source (E. S. R., 62, p. 198).

Vitamin D in ergot of rye. E. MELLANBY, E. SURIE and D. C. HARRISON (*Biochem. Jour.*, 23 (1929), No. 4, pp. 710-717, pl. 1).—A further investigation of the calcifying action of rye ergot (E. S. R., 60, p. 296) is reported, with the conclusion that the factor responsible for this action possesses all the known properties of vitamin D. Rye germ unaffected by the ergot fungus was found to carry a very small quantity of vitamin D and rye germ and fungi in general an abundance of ergosterol. Mushrooms gave no evidence of vitamin D, nor was there any evidence of further synthesis of vitamin D in unground ergot on exposure to strong sunlight or of more than a slight increase on exposure to a mercury vapor lamp.

The problem of the synthesis of vitamin D in ergot thus remains unsolved. It is stated that some samples of ergot contain about one-eighth to one-fourth the calcifying activity of cod-liver oil, and that all samples thus far tested, whether of Russian or Spanish origin, are definitely antirachitic.

Vitamin D from sterols of mummified Egyptian brain. H. KING, O. ROSENHELM, and T. A. WEBSTER (*Biochem. Jour.*, 23 (1929), No. 2, pp. 166, 167).—An illustration of the remarkable stability of ergosterol when present in minute amounts in ordinary cholesterol from animal sources is furnished by the

demonstration that the ergosterol content of cholesterol isolated from the brains of a mummy dating from about 500 A. D. was of the same order as that of cholesterol prepared from fresh brain, as determined by its antirachitic action after irradiation.

A second thermolabile water-soluble accessory factor necessary for the nutrition of the rat. V. READER (*Biochem. Jour.*, 23 (1929), No. 4, pp. 689-694, figs. 6).—Evidence is presented leading to the conclusion that yeast extract, marmite, contains in addition to vitamins B₁ and B₂ (F and G) a second thermolabile factor B₃. Both B₁ and B₂ are inactivated by alkaline hydrolysis of the yeast extract at pH 9 and a temperature of 120° C. for one hour. Hydrolysis in a more acid medium, pH 6, does not destroy vitamin B₁, but apparently destroys more than 50 per cent of B₃. Destruction of vitamin B₃ to a similar extent occurs on heating marmite in a boiling water bath for two hours. Preliminary experiments have indicated that the new factor is not identical with the thermolabile factor thought by Williams and Waterman to be essential for growth in pigeons (*E. S. R.*, 60, p. 293).

Vitamin B. R. A. PETERS (*Nature [London]*, 124 (1929), No. 3124, p. 411).—In a brief note attention is called to the paper by Reader noted above, indicating at least three vitamin B factors present in fresh marmite. The author has found that fresh marmite in the presence of casein and cod-liver oil does not lead to resumption of weight in adult pigeons which have lost weight on polished rice, while this increase does take place on a whole-wheat diet, as previously noted by Williams and Waterman (*E. S. R.*, 60, p. 293). This is thought to indicate that the factor discovered by Reader is not the same as that of Williams and Waterman and, in so far as it is thermolabile, differs from that of Hunt (*E. S. R.*, 60, p. 690). "It should be realized that at least five 'B' factors have now been described: (1) The original thermolabile, antineuritic curative to pigeons; (2) a second thermolabile (V. Reader); (3) a thermostable factor present in alkaline autoclaved marmite (antipellegra, Goldberger, etc.); (4) a second thermostable factor described by Hunt; together with (5) the 'Williams and Waterman' factor. The importance of the latter has at present been demonstrated only in pigeons. According to the exact conditions of the tests, some of these factors must have been included as either B₁ or B₂ in much of the previous work."

Some evidence of the existence of a further factor necessary for growth of the rat. K. H. COWARD, K. M. KEY, and B. G. E. MORGAN (*Biochem. Jour.*, 23 (1929), No. 4, pp. 695-709, figs. 6).—Following the observation that rats often cease to grow even though receiving a diet hitherto considered to be satisfactory in energy value, salt content, digestibility, and content of all recognized vitamins, the authors have tested the value of various supplements to such a diet. It was found that on the vitamin A-free diet with an abundance of cod-liver oil resumption of growth took place following the substitution of so-called "light-white casein" of the British Drug Houses for the vitamin-free casein (Glaxo) generally used in the basal diet. Other substances bringing about rapid response were fresh milk, lettuce, fresh and dried grass, ox muscle, liver, and wheat embryo. Watercress and milk which had been simmered for 15 minutes brought about less rapid growth and butter and etolated wheat shoots very little growth. The presence of this additional growth factor can also be demonstrated in the usual vitamin B (B₁ and B₂) tests, as well as in vitamin A tests, but not as many animals are available because the shorter period required for depletion of the vitamin B reserves and for the test period proper is not always long enough to deplete the animals' store of the new factor.

The importance of supplying this factor in the basal diet of all rats used for growth experiments is emphasized. This can be done in vitamin B experiments by the use of light-white casein, which has been shown to contain no vitamins B₁ and B₂. The presence of some vitamin A makes it necessary to devise some means of removing this vitamin without removing the unknown factor.

Test of the physical and chemical properties of the new factor as present in light-white casein indicate that it is partially destroyed by heat, insoluble in cold alcohol, ether, and 2 per cent acetic acid, and partially soluble in boiling alcohol and ether. Although its distribution is similar to that of vitamin E, it bears no relation to it in physiological properties.

Irradiated ergosterol, the modern antirachitic principle, F. R. GREENBAUM (*Amer. Jour. Pharm.*, 101 (1929), No. 6, pp. 417-425).—A concise review of the literature leading to the discovery that vitamin D can be synthesized by the irradiation of ergosterol under suitable conditions. A bibliography of 31 titles is appended.

The status of the therapeutics of irradiated ergosterol, A. F. HESS, J. M. LEWIS, and H. RIVKIN (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 9, pp. 661-665).—This paper reports further clinical experience in the use of irradiated ergosterol in the treatment of rickets and tetany (E. S. R., 60, p. 394) and laboratory experience on the effect of excessive doses of irradiated ergosterol, together with the establishment of a standard dosage based upon biological estimations of antirachitic potency. The value of irradiated ergosterol in the treatment and prevention of other disorders is discussed briefly, with the conclusion that dental caries will not be eradicated by any antirachitic agent however potent, and that irradiated ergosterol is of no value in the prevention or cure of respiratory infections or of anemia, in the healing of ordinary fractures, and in the induction of growth.

The value of irradiated foods is also discussed briefly. In the authors' opinion irradiated milk, especially dried milk, may be of value in preventing rickets and tetany if its potency is carefully supervised and placed under control, but that irradiated cereals will probably play no rôle in the control of rickets owing to the fact that rickets is a disorder of the first year of life during which only small amounts of cereals can be fed. "Such a food may be regarded as an adjuvant to other antirachitic measures, and perhaps of value in later childhood when the requirement of the antirachitic factor has become greatly reduced."

Viosterol (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 9, p. 693).—Viosterol is the term adopted by the Council on Pharmacy and Chemistry of the American Medical Association to designate irradiated ergosterol dissolved in oil. Preparations of Viosterol and cod-liver oil with Viosterol which have been accepted for admission to New and Nonofficial Remedies are listed and described, with the correct dosage for infants and young children. Qualifying phrases 100 D, 5 D, etc., have been adopted to designate the vitamin D potency of the various preparations as multiples of the vitamin D potency of potent cod-liver oil.

Viosterol: Irradiated ergosterol (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 9, pp. 694, 695).—This is an editorial discussion of the above-noted paper of Hess, Lewis, and Rivkin and the announcement of the Council of Pharmacy and Chemistry concerning authorized preparations of Viosterol, irradiated ergosterol.

The action of irradiated ergosterol in the rabbit, M. I. SMITH and E. ELVOYE (*Pub. Health Epts.* [U. S.], 44 (1929), No. 21, pp. 1245-1256).—The action of irradiated ergosterol has been studied in full grown rabbits with special reference to the toxicity of the product and its effect upon serum calcium and inorganic phosphate and upon tissue calcium. The irradiated

ergosterol was administered in solution in almond oil and was approximately 160,000 times as potent, weight for weight, as a good grade of cod-liver oil, the minimum curative dosage for rats on the Steenbock rachitic ration being 0.0005 mg. daily.

The toxicity was studied in a series of 27 rabbits weighing from 2.2 to 2.6 kg. each. The irradiated ergosterol was administered either orally or intramuscularly from 3 to 4 times a week in doses ranging from 0.5 to 10 mg. Doses as high as 1 mg. were well tolerated, while doses of 2 mg. or over proved fatal in most cases. The tissues of the animals receiving toxic doses showed much calcium deposition, particularly in the thoracic aorta, kidneys, and lungs. The serum calcium showed a tendency to progressive increase with increasing dosage, the increase amounting to from 38 to 49 per cent above normal values. Small doses produced variable results. The inorganic phosphate of the serum, although subject to large normal fluctuations, also showed a definite increase with the larger doses.

Calcium determinations of the various organs showed with doses of 2 mg. or over an enormous increase in the calcium content of the kidneys and lungs, but not of the liver or gluteal muscle. The spleen appeared to store a small amount. The deposition of calcium appeared to depend not only upon the level of calcium in the blood, but also on that of phosphorus. "A positive serum phosphate, together with a positive serum calcium, even though the absolute level of the latter is not so high, has generally resulted in much tissue calcification, while negative serum phosphate values, no matter how high the serum calcium values may have been, have not resulted in abnormal deposition of calcium in the tissues."

In conclusion, the authors emphasize the harm that may result from the careless clinical use of irradiated ergosterol or from the haphazard consumption of irradiated foodstuffs.

Effects of excessive doses of irradiated ergosterol in growing rats and dogs. G. F. CARTLAND, J. H. SPEER, and F. W. HEYL (*Jour. Pharmacol. and Expt. Ther.*, 36 (1929), No. 4, pp. 619-628, figs. 2).—In the rat experiments, 3 groups of 3 male rats 7 to 8 weeks old were used, the selection being such that litter mates were represented in each of the groups. The diet consisted of whole wheat 65, whole milk powder 32.5, sodium chloride 1, and calcium lactate 1.5 parts and contained 0.612 per cent of calcium and 0.48 per cent of phosphorus. Irradiated ergosterol in olive oil of a potency of 20,000 rat units per milligram was fed in amounts of 0.00005, 0.005, and 0.05 mg. daily to each of the rats in the 3 groups, respectively. After a 7-day fore period, the calcium and phosphorus metabolism was studied during a 4-weeks test period. After another 4 weeks the rats were killed and the blood and tissues analyzed for calcium.

In the dog experiments, 2 sister English setter pups were weaned at the age of 6 weeks and placed on a diet of whole wheat bread and milk, with meat twice a week after the second week. One of the dogs received 10 cc. daily of cod-liver oil in which was dissolved 0.01 mg. of irradiated ergosterol per cubic centimeter, and the other the same amount of cod-liver oil containing 1 mg. of irradiated ergosterol per cubic centimeter. These amounts corresponded to 2,000 and 200,000 rat units of vitamin D daily. The blood was analyzed for calcium and phosphorus at the end of 3, 8, and 16 weeks, and during the ninth week X-ray photographs were taken. At the end of the eighteenth week the dogs were killed and samples of the tissues taken for histological examination and calcium analyses.

In both series no evidence was obtained of any toxic effects as judged by any of the tests. "We conclude that when the vitamin content of the diet is complete and adequate, an increase of the vitamin D intake in normal, grow-

ing rats and dogs, up to 1,000 times the minimum effective dose produces no effect upon growth, calcium and phosphorus metabolism, blood calcium or phosphorus, or upon the histological structure or calcium content of the tissues."

Harmlessness of large doses of irradiated ergosterol [trans. title], E. LESNÉ and R. CLÉMENT (*Compt. Rend. Soc. Biol. [Paris]*, 101 (1929), No. 25, p. 1023).—Irradiated ergosterol in doses of 16 mg. daily has been given to 40-gm. rats on a normal ration with no harmful effects either macroscopic or microscopic. It is also reported that irradiated ergosterol has been administered to a 15-year-old girl suffering from chronic spasmophilia, with marked diminution in symptoms. The material was given in doses of 32 mg. daily during the first 15 days, after which (owing to slight diarrhea) the dosage was reduced to 16 mg. daily. A 4-months-old baby was given 32 mg. of the irradiated ergosterol daily for several days with no harmful effects.

Sources of ultra-violet radiation and their physical characteristics, W. W. COBLENTZ (*Jour. Amer. Med. Assoc.*, 92 (1929), No. 22, pp. 1834-1837, figs. 4).—A brief summary of the nature of the radiations from the tungsten filament lamp, the nickel and the tungsten arc, the quartz mercury arc, and the carbon arc.

The zinc sulphide method of measuring ultra-violet radiation and the results of a year's observations on Baltimore sunshine, J. H. CLARK (*Amer. Jour. Hyg.*, 9 (1929), No. 3, pp. 646-662, figs. 10).—Various methods in use for measuring the intensity of ultra-violet radiation are discussed, and an improvement in the author's zinc sulfide method is described in detail.

With the use of this method measurements of solar ultra-violet radiation were made in Baltimore for 15 consecutive months. The results compared favorably with those obtained by other methods and indicated a maximum intensity in August and a minimum early in January. The ratio of the two intensities was 8:1. Calculated in ergs per square centimeter per second the minimum and maximum intensities were 500 and 4,000 ergs.

Note on observation of ultra-violet radiation of sun and sky measured by the zinc sulphide method in Boulder, Colorado, J. R. EARP (*Amer. Jour. Hyg.*, 9 (1929), No. 3, pp. 663-665, figs. 3).—Observations similar to those noted above have been made by the same method in Boulder, Colorado, with the following significant variations: The summer maxima in the two places were closely alike, but the winter radiation in Baltimore was only about one-third of that in Boulder. No significant seasonal variation in sky shine from summer to winter was noted in Boulder, but a regular and well-marked variation in Baltimore was observed. High readings in Boulder in November were attributed to the presence of fresh snow. In Baltimore there was a tendency to higher readings in the forenoon, but in Boulder the typical curve appeared to have a maximum about 11 a. m. with a plateau of high readings in the early afternoon.

The ultraviolet component of the sunlight of Portland, Ore., measured by the acetone-methylene blue method, I. A. MANVILLE (*Amer. Jour. Diseases Children*, 37 (1929), No. 5, pp. 972-996, figs. 11).—Included in this paper are an extensive review of the literature on the amount of ultra-violet radiation in sunlight in different parts of the world, a report of daily determinations by the acetone-methylene blue method of the amount of ultra-violet light in the sunlight of Portland, Oreg., from February 10 to September 30, 1923, inclusive, and a comparison of the available sunshine in this city with that in other places throughout the country.

Portland, Oreg., considered to be a representative locality of the Northwest, had the lowest average of sunshine of all areas in the United States, although the averages for Michigan, Maine, Vermont, New York, and the Ohio Valley

were nearly as low. The percentages of ultra-violet light showed marked fluctuations during the entire period in which determinations were made. Instead of increasing gradually from spring to summer, in only one month, July, was the average higher than in February. Not less than one-half the entire amount of ultra-violet light on any one day was received between 10 a. m. and 1 p. m. Curves for ultra-violet light plotted against temperature, rainfall, and sunshine, respectively, showed the closest correlation between ultra-violet light and sunshine and the least between ultra-violet light and temperature.

The clinical value of sunlight through ultraviolet transmitting glass, G. W. CALDWELL and R. H. DENNETT (*Jour. Amer. Med. Assoc.*, 92 (1929), No. 25, pp. 2088-2090).—Based upon their experience in the use of a small Vitaglass inclosed solarium at the New York Post-Graduate Hospital in the treatment of 35 convalescent children, the authors draw the following conclusions:

"Infants and children may be given sun baths of two or three hours daily throughout the winter, not as a substitute for ultra-violet lamp irradiation in the cure of disease but as a prophylactic measure. There are ample ultra-violet rays in the antirachitic range in this latitude during the winter to be of definite value to those receiving them through this type of window glass when exposures are made in the direct path of the sun's rays, since enough of these rays penetrate the glass to prevent rickets and spasmophilia in a normal, properly fed infant."

Irradiation and health.—A, Ultra-violet irradiation of school children, D. COLEBROOK ([*Gt. Brit.*] *Med. Research Council, Spec. Rpt. Ser. No. 131* (1929), pp. 1-32, figs. 5).—This is a report of a well-controlled investigation of the effect of systematic irradiation on the health and development of school children. A total of 287 children from 5 to 7 years of age were kept under medical observation from the end of August, 1927, to the end of March, 1928. During this time 101 of the children were irradiated by light from a carbon arc lamp with high output of ultra-violet rays, 94 were exposed under the same conditions to a similar lamp screened by window glass, and 92 received no treatment. The number of treatments given each child varied from 6 to over 60. Records were kept of height and weight, progress in school, incidence and duration of colds and allied conditions, incidence of infectious fevers, and occurrence of chilblains.

The result in terms of benefit from the light treatment were entirely negative. In commenting upon this in the preface, the council states that until valid evidence, under conditions as critically controlled as in the present investigation, has been obtained showing that some kind of radiation applied under conditions attainable in the wholesale treatment of school children is of benefit, "it is proper to doubt whether light treatment under such conditions will have any real benefit, and, further, whether the greater incidence of minor ailments among school children in an urban area during the winter months is due in any significant degree to deficiency of light as such. Certainly until such evidence is forthcoming there is no ground for expecting that the bad effects of urban and industrial pollution of the air can be offset to any serious degree by such periodical artificial irradiation as can be given to healthy people following their normal occupations."

Therapeutic effects of ultra-violet irradiation (*Brit. Med. Jour.*, No. 3586 (1929), pp. 585, 586).—A review of the publication noted above.

Ultraviolet irradiation of food on a tonnage basis, M. J. DOBCAS (*Food Indus.*, 1 (1929), No. 11, pp. 504, 505, fig. 1).—A brief description is given of large-scale methods of irradiating food materials. For liquids two methods may be used: (1) Agitating the liquid in a deep vat placed under the light source and (2) allowing a thin film of the liquid to fall past the source of

light. For solids the latter method only is feasible. The material is spread in a thin layer on a belt and allowed to fall once or twice to lower belts, with exposure to the light source. A diagrammatic sketch is given of an apparatus for irradiating solid foodstuffs.

A study of the antirachitic value of irradiated powdered whole milk, A. G. DESANCTIS, L. O. ASHTON, and O. L. STRINGFIELD (*Arch. Ped.*, 46 (1929), No. 5, pp. 297-311).—In this study, conducted at the New York Post-Graduate Medical School and Hospital, 100 per cent irradiated powdered whole milk without any added antirachitic agent was fed to 30 infants over a period of several months during the winter of 1927-28.

The average weekly gain was 6 oz. Secondary anemia was not noted in any of the cases. Twenty-four of the infants were completely protected against rickets, five showed no clinical symptoms but slight evidence on X-ray examination, and one was not protected.

The therapeutic value of irradiated milk in the treatment of rickets, C. WATSON and T. Y. FINLAY (*Lancet [London]*, 1929, II, No. 14, pp. 704-707, figs. 8).—Clinical observations and radiographic findings, the latter by J. B. King, are reported for the use of irradiated fresh milk in the treatment of rickets. Two methods of irradiating the milk were followed—the Schell system in which the milk is allowed to flow in a thin film over a surface 3 in. from the lamp in a water-cooled chamber in which the air has been displaced by carbon dioxide, and the Scheidt so-called cold process in which the milk is forced from the bottom to the top of a long quartz tube, with exposure to ultra-violet rays produced by a high-tension electric current sent through a vacuum tube filled with argon gas. It is stated that the second process does not alter the flavor of the milk but that the first slightly modifies it. The first process was used in the series of 12 cases reported upon in this communication, but it is stated that equally favorable results were obtained with the other process.

In children from 2 to 5 years of age excellent results were obtained with a mixture of irradiated and nonirradiated milk in the proportions of 1 part of the former to 2 parts of the latter up to equal parts of the two. In the opinion of the authors "the cure of the disease is established more quickly, effectively, and economically by the use of irradiated milk than by various irradiated commercial preparations." It is estimated that the milk cure of rickets can be effected at a total cost of 1s., whereas the cost with special irradiated medicinal products would be approximately 18s.

The antirachitic action of certain cholesteryl esters in the Burgundy snail, *Helix pomatia* [trans. title], G. MOURICQAND and A. LEULLIER (*Compt. Rend. Acad. Sci. [Paris]*, 188 (1929), No. 26, pp. 1701, 1702).—A mixture of cholesterol and cholesteryl esters from the edible snail was found to have powerful antirachitic properties on irradiation, a single drop of a 1 : 1,000 solution proving effective in the cure of rats on the Sherman-Pappenheimer diet 85.

Nature of the rickets-producing factor in cereals, L. MURVISH (*Nature [London]*, 124 (1929), No. 3124, pp. 410, 411).—The author claims to have obtained an extract from oatmeal which, on injection into rabbits, lowers the blood calcium to a similar extent as do extracts of bovine ovaries. This is thought to indicate that rickets "can not be conceived to be purely a vitamin deficiency condition, but is primarily and ultimately due to a lowering of the blood calcium. This lowering of the blood calcium (and a low blood phosphorus is most probably secondary to it) can be produced by lack of vitamin D, by the administration of cereals, or by a faulty calcium to phosphorus ratio in the diet. Actually, rickets may yet prove to be a manifestation of hypoparathyroidism in young growing animals. If that is the case, our present concep-

tion of the rôle of vitamin D and probably of the other vitamins will have to change very appreciably."

A study of the pellagra-preventive action of canned salmon. J. GOLDBERGER and G. A. WHEELER (*Pub. Health Rpts. [U. S.]*, 44 (1929), No. 46, pp. 2769-2771).—Canned salmon, previously found to be effective in the prevention of blacktongue in dogs, has been used in the pellagra-preventive treatment of a total of 13 white insane female pellagrins with no recurrence of the disease during the year or more of treatment. This is thought to furnish additional evidence that blacktongue in dogs is the analogue of pellagra in man. Canned salmon is suggested as a possible substitute for meat in the areas of pellagra endemicity when meat is not readily available.

The physiology of glycogen and the rôle of insulin and epinephrine in carbohydrate metabolism. J. J. R. MACLEOD (*Lancet [London]*, 1929, II, Nos. 1, pp. 1-7, figs. 3; 2, pp. 55-60, fig. 1; 3, pp. 107-113, fig. 1).—Two lectures delivered at the London Hospital.

Dietary control of dental caries. J. D. BOYD, C. L. DRAIN, and M. V. NELSON (*Amer. Jour. Diseases Children* 38 (1929), No. 4, pp. 721-725).—In order to answer the question as to whether or not the arrest of dental caries in diabetic children under careful diet control with insulin (*E. S. R.*, 59, p. 893) might be due to some factor other than that of the adequacy of the diet, four nondiabetic patients in the children's orthopedic ward in the same hospital, all with dental caries, were given similar diets to those of the diabetic children but with no insulin. All of the children showed arrest of caries after about two months. Two of them were then returned to the ward routine with voluntary consumption of food from the ordinary ward diet. After several months both of these children were found to have active caries and one had three new cavities.

A further study was then conducted under home conditions with a group of children of preschool age, each of whom had actively progressive caries. Each child received daily a quart of milk, 1 egg, a teaspoonful of cod-liver oil, 1 oz. of butter, 1 orange, and 2 or more servings of succulent vegetables and fruits. Candy was allowed after meals, but at no other time. No other dietary restrictions were made except that foods which might tend to displace some of the prescribed items were prohibited. Five children were under observation until the caries had been arrested completely, and in no instance did this require more than 10 weeks. The diets in this group contained carbohydrate, protein, and fat in liberal amounts, while those in the hospital groups furnished limited amounts of carbohydrate, little free sugar, and large amounts of fat.

A final group of four girls with celiac disease was placed under observation at the hospital on diets high in carbohydrate and protein and with practically no fat. The two older children had extensive caries at the beginning of the treatment and the two younger ones had not developed caries. Caries was arrested in the older children and did not develop in the younger.

The dietary factors in common in these four groups of children, in all of whom caries was arrested or prevented, were liberal allowances of vitamins and minerals and at least a gram of protein per pound of body weight. The authors are of the opinion that active caries is indicative of nutritional deficiencies which may not be apparent in any other way.

"These observations have not pointed to any one food component as specific in the maintenance of dental integrity. Our present concept is that it may depend on the adequacy of the diet in all essential factors. Nothing has been noted which would indicate that the arrest of caries was primarily dependent on the limitation of the amount of any of the foods commonly used. However, the use of any component in excessive amounts may lead to the omission from the diet of other essential foods, and such omission may render the teeth sus-

ceptible to decay. If extensive use of sugars and starches is found associated with caries, it is probably to be explained on this basis."

The regeneration of hemoglobin and erythrocytes, F. S. ROBSCHERT ROBBINS (*Physiol. Rev.*, 9 (1929), No. 4, pp. 666-709, fig. 1).—Included in this critical discussion of the literature on the subject is a valuable summary of the effect of various dietary factors on regeneration of hemoglobin and erythrocytes. A bibliography of 132 titles is appended.

Studies on the anemia of rice disease in rats.—The influence of vitamin: A, B, D, iron, copper, beef muscle, and liver on the course and regeneration from the anemia of rice disease, R. W. WHITEHEAD and O. W. BARLOW (*Amer. Jour. Physiol.*, 89 (1929), No. 3, pp. 542-547, fig. 1).—This and the following paper report an investigation similar to the ones previously conducted on pigeons (*E. S. R.*, 58, p. 594; 60, p. 492).

Albino rats were subjected for a prolonged period to a polished rice diet to which, except in the case of controls, various dietary correctives were added and determinations were made of the blood concentration and the hemoglobin and erythrocyte content. On polished rice, cooked or uncooked, there was a marked loss in body weight and in the hemoglobin content of the blood and a less marked decrease in the erythrocyte count. The addition of cod-liver oil was without beneficial effect, but compressed yeast in the proportion of 2 per cent of the daily food intake practically prevented the loss in weight and limited the degree of anemia. Therapeutic doses of iron and copper were ineffective either in curative or prophylactic treatment. Lean beef muscle or liver, either added to the rice diet or substituted for the rice, was more effective than any other procedure tested in curing the anemia.

A comparison of the body weights, erythrocyte counts, and total blood volumes of normal, beriberi, and fasting rats.—The influence of lactose, mineral oil, and magnesium carbonate on the anemia of rice disease, O. W. BARLOW and R. W. WHITEHEAD (*Amer. Jour. Physiol.*, 89 (1929), No. 3, pp. 548-554, figs. 2).—The results obtained in this study were similar to those previously reported for pigeons. "The development of inanition in rats during the course of rice disease or in complete fasting is accompanied by a diminution of the red cell count, hemoglobin, and the total blood volume. The erythrocytes decrease somewhat less than the body weight, and the ratio of blood weight increases. These changes indicate the development of a hydremic plethora. The degree of change is closely associated with the degree of inanition developed. Lactose, magnesium carbonate, or mineral oil tend to antidote the anemia of inanition. The beneficial action noted was not due to blood concentration, but to a diminution of the usual rate of blood destruction."

Heart block in rice-fed pigeons, C. W. CARTER and A. N. DRURY (*Jour. Physiol.*, 68 (1929), No. 2, pp. I, II).—It is stated in abstract that the abnormal cardiac rhythm noted by Peters in pigeons on a polished rice diet is due to heart block, and that the condition is established at an earlier date than polyneuritis or head retraction. The condition is thought to be the result of an overaction of the vagal centers.

An outbreak of botulism from home-canned beets, W. LEVIN (*Amer. Jour. Pub. Health*, 19 (1929), No. 11, pp. 1246, 1247).—A brief report is given of an outbreak of botulism in Oregon traceable to beets canned in the home by boiling for three hours in a kettle closed at the top but not under pressure. The beets had been canned in the summer of 1928 and were used on March 8, 1929. From the juice cultures of *Clostridium botulinum*, type A, were obtained. The strain was evidently not a powerful toxin producer as there was only one fatality among four cases. It is noted that the outbreak is the seventh occurring in Oregon. All of the outbreaks, including 21 cases and 17 deaths,

were caused by home-canned foods, four traceable to string beans and one each to corn, turnips, and beets.

Botulism due to home canned Bartlett pears. K. F. MEYER and J. B. GUNNISON (*Jour. Infect. Diseases*, 45 (1929), No. 2, pp. 133-147).—Home preserved sliced Bartlett pears which had shown definite signs of spoilage and fermentation were tasted by a young woman and child, in both of whom botulism developed within 5 or 6 hours, followed by death within 42 and 30 hours, respectively. Strains of *Clostridium parabotulinum* type A and its resulting toxin were isolated from the pears, and the organism was also isolated from the stomach contents. The H-ion concentration of the pear sirup was pH 3.86. Since botulinus toxin rarely develops at such H-ion concentration, experimental studies were conducted with pears canned under conditions similar to those probably used in canning the fatal product and with artificial contamination by detoxicated spores of the organism. The spores survived 2 or 3 hours' boiling, and in the presence of certain bacteria or yeasts such as are likely to be found in spoiled pears germinated and produced toxin, but failed to germinate in sterile pear juice with the pH adjusted to 6. The explanation of the development of toxin in the product responsible for the fatalities is thought to be as follows:

"The spores of the *C. parabotulinum* strain found in the poisonous Los Banos pears have survived a process of sterilization which in all probability was utterly inadequate, since it permitted the survival of yeasts and bacilli of low heat resistance. The growth of these organisms supplied the factors which are required by the botulinum organism to germinate and to form its toxin. The concentration of the sirup and the buffer content of the water may have been contributory factors. In the light of these experiments one may conclude, furthermore, that pears, whether home or commercially canned, are not subject to botulinum spoilage provided fresh and sound raw material is packed under sanitary conditions. However, a jar with a layer of molds or definite signs of fermentation may contain the deadly poison. The contents should never be tasted but destroyed by mixing with kitchen lye or by boiling."

The measurement of the basal heat production of pigeons.—I, Instrumental technique. II, Physiological technique. F. G. BENEDICT and O. RIDDLE (*Jour. Nutrition*, 1 (1929), No. 6, pp. 475-536, figs. 3).—These two papers describe in detail the apparatus and technique which have been developed for an extensive program of investigation of the basal metabolism of dogs and pigeons, similar to that with rats noted previously (E. S. R., 62, p. 192).

The Scientific Society of the Hygiene of Nutrition. J. ALQUIER (*Jour. Home Econ.*, 22 (1930), No. 2, pp. 105-107, pl. 1).—This is a brief explanation by the general secretary of the Scientific Society of the Hygiene of Nutrition, Paris, France, of the institute which has been established by the society for research and teaching in nutrition. The building, which is illustrated in a frontispiece, includes a large amphitheater, a library, and laboratories of chemistry, physiology, and bioenergetics noted below. The society has presented to the League of Nations a suggestion for the creation of an international scientific commission on nutrition, the purpose of which would be "to consider means of unifying methods of study and investigation dealing with the production and utilization of foods and of gathering the largest possible amount of information on different aspects of the subject which would be of genuine scientific, practical, or administrative value; to instigate experiments, researches, and investigations in the member countries; and to contribute, with the assistance of the various governments and of suitable institutions and

associations, to the development, teaching, and popularization of the sciences that find application in nutrition."

The laboratory of bioenergetics of the Scientific Society of the Hygiene of Nutrition (Institute of Agronomic Researches) [trans. title], J. LEFÈVRE and A. AUGUST (*Bul. Soc. Sci. Hyg. Aliment.*, 17 (1929), No. 9-10, pp. 445-487, figs. 27).—This is a very complete description, with numerous illustrations, of the laboratory of bioenergetics for direct calorimetric determinations which has been installed in the institute maintained by this society, the function of which is noted above.

TEXTILES AND CLOTHING

The rayon industry, M. H. AVRAM (*New York: D. Van Nostrand Co.*, 1929, 2. ed., pp. XXIII+893, figs. 211).—This is a revision of the book noted earlier (E. S. R., 57, p. 96).

Play suits for winter, B. M. VIEMONT (*U. S. Dept. Agr. Leaflet* 54 (1929), pp. 8, figs. 9).—Comfort, self-help, and protection against cold, snow, and rain are the principal factors considered in the winter play suits for little boys and girls described and illustrated in this leaflet of the series noted previously (E. S. R., 62, p. 298).

HOME MANAGEMENT AND EQUIPMENT

Time factors in the business of homemaking in rural Rhode Island, M. WHITTEMORE and B. NEIL (*Rhode Island Sta. Bul.* 221 (1929), pp. 35, figs. 15).—This report is based upon daily records of one week's activities kept by 102 women living on farms or in small communities. Record forms prepared by the Bureau of Home Economics, U. S. D. A., were used. The survey extended from February, 1926, to March, 1929.

Tables and charts are included showing the average time spent in different activities, by groups, based on the average number of persons in the household and on the time spent in home making; comparison of time spent in different activities; number and percentage of women spending different numbers of hours in different activities and having or not having certain labor- and time-saving equipment; and the average, lowest, and highest amounts of time spent in different activities.

An average working day of 7 hours 45 minutes was indicated to have been spent in household activities.

The present use of work time of farm homemakers, I. F. ARNQVIST and E. H. ROBERTS (*Washington Col. Sta. Bul.* 234 (1929), pp. 31, figs. 6).—The data for this study, made in cooperation with the U. S. D. A. Bureau of Home Economics, were secured through detailed records kept by home makers for seven consecutive days considered by themselves to be a typical week. Records were obtained from 137 farm women (18, 59, 32, and 28, respectively, for the spring, summer, autumn and winter seasons); from 21 rural women (living on farms but not producing farm products for sale); and from 39 town women.

The total average number of hours of work per week for the three groups were 62.9, 59.4, and 55.3, respectively, and the average number of hours per week spent on home making were 53, 53.9, and 52.7, and on farm work 9.9, 5.2, and 1.6. Of the farm women, 10 per cent worked less than 49 hours per week, 83 per cent from 49 to 77 hours, and 7 per cent more than 77 hours. The percentages for the rural group were 19, 81, and 0, and for the town group 23, 77, and 0, respectively. The percentages of total time spent by the farm, rural, and town groups, respectively, on different activities were as follows: Food

50, 42, and 45; clothing and textile furnishings 23, 25, and 28; care of house 16, 16.5, and 16; care of family 5.5, 8.5, and 8; household management 3.7, 4, and 4; and miscellaneous activities 1.8, 4, and 4.

The records for the farm group are further analyzed to show the effects of the seasons, kind of farming, and number of children on work time, and the distribution of time spent in different activities with different total hours of work per week. The total average hours of work per week varied from 58.5 in the winter to 66.6 in the spring, the hours in home making from 50.5 in the winter to 54.2 in the summer, and the hours spent in farm work from 7.8 in the winter to 15.1 in the spring. Type of farm or the help received did not materially change the average time spent on home making. Home makers with children worked about 5 hours more per week and spent about 8 hours more time per week in home making than did those without children. The home making tasks of the farm home maker, her family, and other helpers, and the effect of modern equipment on the amount and distribution of her work time are discussed.

MISCELLANEOUS

Fifty-second Report of the Connecticut Agricultural Experiment Station, 1928, W. L. SLATE ET AL. (*Connecticut State Sta. Rpt. 1928, pp. XI+862+XXX, pls. 36, figs. 95*).—This contains the organization list, a report of the board of control for the year ended October 31, 1928, a financial statement for the fiscal year ended June 30, 1928, and reprints of Bulletins 296-307, all of which have been previously noted, and of the following Bulletins of Immediate Information: Nos. 62, The Control of the Asiatic Beetle in Lawns, by R. B. Friend; and 63, The European Corn Borer: A Menace to Corn, Vegetable, and Garden Plants, 64, The Japanese Beetle Quarantine, 65, The Asiatic Beetle Quarantine, 66, The Satin Moth Quarantine, and 67, Control of Ant Invasions, all by W. E. Britton.

Annual Report of the Western Washington Experiment Station, [1929], J. W. KALKUS ET AL. (*Western Washington Sta. Bul. 14-W (1929), pp. 49, figs. 9*).—This contains the organization list, a report by the superintendent, departmental reports, and a financial statement for the fiscal year ended March 31, 1929. The experimental work not previously noted is for the most part abstracted elsewhere in this issue.

Directory of field activities of the Bureau of Plant Industry (*U. S. Dept. Agr., Misc. Pub. 64 (1930), pp. II+108, fig. 1*).—This is a directory of the field activities of this bureau in vest-pocket form.

NOTES

Georgia Station.—A substation to be known as the Georgia Mountain Experiment Station has been established near Blairsville. At this substation experiments will be conducted largely with fruits and vegetables, but cooperative relations have also been established with the State Forestry Association for conducting research in forestry.

Maine University.—Dr. Lucius H. Merrill, professor of biological and agricultural chemistry, has been granted leave of absence and will devote himself largely to his duties as State geologist.

Michigan Station.—Walter Toenjes, research assistant in horticulture, has been appointed superintendent of the Graham Horticultural Substation near Grand Rapids. Franklin Sherman, jr., has been appointed research assistant in entomology, effective March 1, vice L. G. Gentner resigned, and Glenn L. Ricks assistant in horticultural research, effective April 1.

Porto Rico Insular Station.—Within the past year the station has constructed an eight-room addition to its laboratories for the use of the divisions of agronomy, entomology, and plant pathology and for some of the work of the division of chemistry. Two new greenhouses are under construction for the respective use of the divisions of chemistry and plant pathology. The erection in the near future of a new insectary and a new library building is planned.

The soil survey which was started during the winter of 1928-29 by the U. S. D. A. Bureau of Chemistry and Soils is being carried forward in cooperation with the station in three areas. It is planned to continue this survey until the entire island has been covered.

A substation in the new irrigation district near Isabela, which is in charge of L. A. Serrano, has completed its first year with encouraging progress.

During the past year the following new members have been added to the station staff: Dr. Thomas Bregger, plant breeder; Dr. M. D. Leonard, entomologist; B. G. Capó, assistant chemist; and C. J. Clavell, assistant agronomist.

Virginia College and Station.—Appropriations were made by the general assembly prior to adjourning on March 8 whereby the college receives an increase of 10 per cent for maintenance and the extension division an increase of 20 per cent. In addition the following capital outlay items were provided: For an engineering laboratory \$50,000, a dairy products building and equipment \$150,000, completion of the science building \$74,000, a physics building \$100,000, an agricultural engineering laboratory \$30,000, and for additional equipment, sewers, heating extensions, walks, etc., \$96,000.

An increase of 20 per cent was also given the station under a plan whereby the State and Federal fiscal years will hereafter coincide. There was appropriated \$33,430 for the period from March 1 to June 30, 1930, \$101,470 for the fiscal year ending June 30, 1931, and \$97,470 for the ensuing fiscal year. In addition cooperation by the State in the Federal soil survey was authorized with a special appropriation of \$7,500 per annum for the fiscal years 1931 and 1932.

Dr. J. G. Ferneyhough, a member of the board of visitors of the college, died March 4.

EXPERIMENT STATION RECORD

VOL. 62

MAY, 1930

No. 7

The recent retirement of Director D. W. May, for nearly 26 years in charge of the Federal Experiment Station in Porto Rico, brings to a close a distinctive chapter in the history of that station. While agricultural experimentation in Porto Rico under Federal auspices had been begun about three years prior to his coming to the island in 1904, it had for the most part been carried on in temporary quarters at Rio Piedras and was interrupted by the transfer of operations to the permanent location at Mayaguez, so that his quarter century of leadership is well-nigh contemporaneous with the active upbuilding and development of the station on its present basis. In its progress he has had the loyal support of many able associates, some for considerable periods. Yet with full acknowledgment of the work of others, the fact remains that with the passing of the years Director May had come to be looked upon as almost personifying certain aspects of the Federal station enterprise in Porto Rico, and his retirement at the age of 62 years as authorized by the Federal law relative to tropical service means the withdrawal of an outstanding figure from the field of station administration at a strategic point.

Although it may seem anomalous to use the term pioneering in connection with agriculture in a region whose cultivation and exploitation antedated by 100 years the coming of the English colonists to Jamestown, the immediate task of the Porto Rico Station was essentially of that description. Instituted shortly after the transfer of the custody of the island from Spain to the United States, the station faced the difficult problems presented by a radical readjustment in economic conditions imposed upon a land already handicapped by a dense population with little capital, inadequate transportation facilities, and high illiteracy.

The agriculture of the island likewise was primitive and backward. In the words of the report of this Office in 1901, "little is known relating to the growing of any crops other than coffee, sugar, and tobacco, and the cultural methods of these three are very poor. There is a dearth of skilled labor and an excess of the poorest and

most ignorant kind. Improved implements of any sort are rarely used. . . . There is need of the introduction of improved machinery, as well as of seeds, plants, and animals to take the place of those that are now so deteriorated through lack of selection and proper care that they are valueless. There is a good field for the development of some of the tropical fruits by selection, breeding, and better methods of management and their introduction into good markets. Last, but not least, the people should be taught and encouraged to adopt improved methods and fit themselves for a more intelligent management of agricultural affairs."

Under these circumstances, the early work of the station was clearly pioneering, not only in the methods of agriculture but in the crops selected, the plants and animals introduced, the finding of markets, and the instruction through correspondence and extension work of the people. Moreover it should be recalled that experimentation in tropical agriculture was then in itself a virtually virgin field. The experiment stations and similar research institutions in existence were almost without exception in the Temperate Zone, making necessary special studies as to many of the most elementary facts to determine their applicability to tropical conditions.

The land bought for the new station was typical of the prevailing situation on the island. Of the tract of 235 acres which was secured, about 7 acres had been set to coffee, but the remainder was practically an abandoned farm with the land in an unproductive state and overgrown with weeds, bushes, and small trees intermingled with a small amount of various kinds of grasses. Considerable time was required for the clearing, draining, and fencing of the tract, the repair of the existing buildings and the erection of others, and similar preliminary operations. Much of this work was eventually carried on by the regular farm labor as opportunity permitted. This policy was occasioned largely by restricted funds, and while not without disadvantages eventually resulted in the development of a well-organized and equipped station at a surprisingly moderate financial outlay.

One of the immediate objectives of the station was that of securing greater diversification in Porto Rican agriculture. Specialization had become well-nigh complete in producing sugar, coffee, and tobacco for export, and it was seen to be very essential that there should be greater attention to food production for home consumption, with a view especially to improving the living conditions of the laboring classes. Other crops demanded investigation as to their commercial possibilities, and improved varieties, better cultural methods, and knowledge of means of combating insect pests and plant diseases were much needed in the case of both of the

staple crops and those less commonly grown. Work with livestock presented another alluring field, as the animals in the island had not only failed of improvement since the early introductions but had actually degenerated.

When the station was founded sugar was the leading crop, as it is to-day. Here the work of the station has been in the introduction of the better canes from other regions and the breeding of new varieties by sowing the seed produced in the tassels and systematic crossings. Some of the varieties introduced have been a great improvement over those previously cultivated, not only increasing the yield of sugar per acre but proving resistant to diseases with which the varieties then grown were suffering. One introduced cane, brought in by the station with the view of combating a disease that was devastating the cane fields, showed such pronounced merit that the planters in gratitude issued a memorial accompanied by a cup thanking the station for its work in saving their industry.

Although coffee was at one time the largest crop in point of value, at the time the station was established production was languishing, in part because of decreased yields brought about by depleted soils and degeneration of stock and in part because of economic conditions. Work by the station with this crop was promptly undertaken, both on the station grounds, an old coffee grove near Ponce developed as a substation, and at various points in cooperation with planters. Methods of cultivation were improved, the use of fertilizers was extensively studied, and a number of new varieties were introduced, especially of the Robusta type, for which the demand in the mainland markets is more favorable.

Considerable work was done in the early years on tobacco, an industry then rapidly expanding in the island in acreage and improving in quality. The White Burley type was introduced from Kentucky and found to grow vigorously and produce heavy yields. Various cultural and curing operations were also studied by a special tobacco expert for several years.

Wild citrus fruits had long been plentiful on the island, but there was little cultivation and no exportation. The station has introduced better varieties of oranges, grapefruit, and lemons, has developed methods of spraying, cultivating, and fertilizing, and has assisted materially in obtaining markets for the fruit. The results have been most encouraging. The citrus industry is now the second in point of value in Porto Rico and is continuing to make rapid growth.

Another crop not grown commercially before the American occupation was the pineapple. Since the introduction of improved varieties and cultural methods, it has become second only to the

citrus group in fruit production. A large export trade has been developed, as well as many local canneries.

Another noteworthy accomplishment by the station is its success in stimulating the growing of vegetables, both for home consumption and for export. At the beginning of its campaign, some of the well-known vegetables of the Temperate Zone were unknown in Porto Rico and others were of degenerated types or wild forms and of little value. To-day home-grown vegetables can be found in the island markets throughout the year, and the export trade is increasing rapidly, especially during the winter months.

One of the great needs of Porto Rican agriculture has been the acclimatization of suitable forage crops, and, in view of the depleted condition of the soil, desirable legumes. A number of the station introductions have given excellent results, among them the velvet-bean, various peas, elephant grass, and Guatemala grass.

The interests of the station, however, have been by no means confined to plants, and some of its most striking achievements have been with livestock. Importations of registered animals were begun in 1904 by the station for its own use and that of others, and have exerted an influence far beyond the actual number of animals imported. Horses, principally thoroughbred or harness breeds, have greatly improved the stock of the island, although in late years there has been a decreased use of these animals due to the automobile. With cattle the work has been mainly with the dairy breeds. Striking results have followed the crossing of Guernseys and Holsteins with the native cattle, including earlier maturity and largely increased yields of milk. Dairying has been put on a business basis, and the trend toward modern sanitation has been revolutionary. The improvement in the poultry has also been pronounced. Other introductions that have proved of value have been certain toads and frogs that have operated to check the ravages of noxious insects, especially the mole cricket, and such insect-eating birds as the pheasant.

One of the great handicaps to the general importation of purebred stock has been the prevalence of the cattle tick. That this obstacle need not be insuperable was demonstrated years ago by Director May, who by systematic dipping and other standard methods brought about its eradication from the station premises. No island-wide campaign has thus far been feasible, but the object lesson of its practicability has none the less led to much improvement in the general situation.

Taken as a whole, the agricultural progress of the island since the station began its work is very remarkable. Visitors returning after a lapse of years note a great improvement in the appearance of the

people and their farms, and find that not only are they living and dressing better but that there is a large increase in the imports and exports. From 1901, when the exports aggregated \$8,000,000 in value, there was a steady gain to a high-water mark in 1921 of \$151,000,000, and while various causes have resulted in somewhat smaller figures for recent years, they still remain at an impressive level. Not all of this gain, of course, is to be credited specifically to the station, but the esteem with which it is locally regarded indicates that its share therein is by no means small.

Nor can the full benefits of a quarter century of experimental work be measured entirely in tangible terms. From the first the station has realized that its distinctive responsibility included the conveying of its findings to the farmers themselves, and that in the absence of a separate extension staff much of its work would necessarily include the formation of direct contacts and the cultivation of close relations. Moreover, it has exercised a strong influence in the development of auxiliary agencies. Thus the station was directly helpful in securing the establishment of the College of Agriculture, and Director May was for 15 years a member of the college board of trustees.

Despite the pioneer nature of its early work and the necessity of so carrying it on as to make its results immediately and practically available, the Porto Rico Station has set a helpful example by a consistent adherence to high standards of research. Its comprehensive investigations in soil chemistry may be referred to as an instance of the more fundamental type of inquiry which has, so far as the means and the men available have permitted, been consistently blended with the simpler forms of inquiry. Much of its work has been of immediate local application, but the station has been far more than a local institution.

The task of carrying on the work now relinquished by Director May after so many years of able, zealous, and constructive leadership is by no means one to be lightly regarded. It demands among other qualifications an unusual combination of sound fundamental training, a knowledge of and full sympathy with the distinctive problems of the Tropics, and a temperament which is at once sanguine, patient, and persistent. Fortunately the Department has been able to secure for the position Dr. George F. Freeman, formerly of the experiment stations of Kansas, Arizona, and Texas and more recently engaged in cotton research in Egypt, an agricultural and economic mission to Indo-China, and since 1923 the administration as director general of the technical service of the department of agriculture in Haiti. Dr. Freeman has already entered upon his new duties. He will take with him the best wishes of all who are interested in the progress of agricultural experimentation in the Tropics and the development of an improved agricultural practice in Porto Rico.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

The molecular weight of casein, I. T. SVEDBERG and L. M. and D. C. CARPENTER (*Jour. Amer. Chem. Soc.*, 52 (1930), No. 1, pp. 241-252, figs. 5).—This research was carried out jointly by the University of Upsala Physicochemical Laboratories and the New York State Experiment Station. The results are in part summarized in the following statements:

"Casein prepared by the Hammarsten method has been examined at pH 6.8 in phosphate buffer solution by the centrifugal sedimentation velocity method and found to consist of a mixture of protein molecules of different weight. Hammarsten casein was extracted with hot acidified 70 per cent alcohol and the soluble protein precipitated out with dilute sodium hydroxide. This protein after washing was dissolved in phosphate buffer solution of pH 6.8. Various concentrations were examined by both the sedimentation velocity and sedimentation equilibrium methods. It was found that within the limits of experimental error the acid-alcohol soluble protein was homogeneous with regard to molecular weight, and that it therefore probably was a pure chemical individual. The molecular weight was found to be $375,000 \pm 11,000$. The molecule was not spherical, and deviated from the spherical shape by about the same amount that has been found for several other proteins."

The structure of surface films.—Part XIII, Sterols and their derivatives, N. K. ADAM and O. ROSENHEIM (*Roy. Soc. [London], Proc., Ser. A*, 126 (1929), No. A 800, pp. 25-34, figs. 3).—Results of the examination of monomolecular surface films of numerous sterols and related compounds are reported and discussed with reference to the probable structural formulas of these compounds.

Monomolecular films of irradiated ergosterol in relation to the production of vitamin D, O. ROSENHEIM and N. K. ADAM (*Roy. Soc. [London], Proc., Ser. B*, 105 (1929), No. B 738, pp. 422-428, figs. 2).—A study of the monomolecular surface films on water of ergosterol and of the three products formed from it on irradiation, as described by Bourdillon et al. (*E. S. R.*, 62, p. 114), has shown a resemblance between the films of the irradiation products and those of certain ketonic cholesterol derivatives. The product having an absorption band at 280μ (probably vitamin D) resembled that of oxycholesterylene. This compound, however, has no antirachitic properties before or after irradiation. It is considered at present impossible to decide which constituent of the mixture containing the active substance represents the vitamin. Alternative possibilities are that the vitamin may be a ketone itself or that the highly absorptive unsaturated ketone may constitute the biologically inactive portion of the mixture, the vitamin itself being in the remaining portion in minute amounts only. It is thought that if the latter explanation proves to be the correct one the vitamin is one of the ergosterol derivatives resulting as by-products in the ketone formation. In either case the lability

of the hydrogen of the $\text{CH}(\text{OH})$ group is considered to be the controlling factor of the changes induced by ultra-violet irradiation of ergosterol.

Improvements in the method of isolating the anti-beri-beri vitamin, B. C. P. JANSEN (*Rec. Trav. Chim. Pays-Bas*, 48 (1929), No. 9, pp. 984, 985).—The method of preparing a concentrate of the antineuritic vitamin B previously described by Jansen and Donath (*E. S. R.*, 57, p. 489) has been modified by replacing the phosphotungstic acid by silicotungstic acid and the alcoholic solution of platinum chloride by a solution of cadmium chloride in absolute alcohol. The silicotungstic acid is considered to precipitate the vitamin more completely than phosphotungstic acid. The chief advantage of the substitution of cadmium for platinum chloride is that it is so cheap in comparison with platinum chloride that it is not necessary to recover it. In using it care must be taken that the volume of the alcoholic solution containing the vitamin from 100 kg. of rice bran does not exceed 500 cc. It is said that the yield of active material has been about doubled by these changes in technic.

An improvement in the quantitative assay of the antiscorvy vitamin (C), W. H. EDDY (*Amer. Jour. Pub. Health*, 19 (1929), No. 12, pp. 1309–1320, figs. 5).—A brief review of the literature on the quantitative determination of vitamin C is followed by a comparison of the methods of Hütter (*E. S. R.*, 57, p. 205) and of Sherman, Lamer, and Campbell (*E. S. R.*, 46, p. 865) as applied to canned string beans, orange juice, and bananas. The basal diet used was a slight modification of the original Sherman diet, consisting of baked skim milk 30, butterfat 9, salt 1, equal parts of rolled oats and bran 59, and cod-liver oil 1 per cent. plus a certain amount of yeast fed separately.

Of all three of the materials about twice as much was required to prevent tooth changes characteristic of scurvy as to prevent the external symptoms of scurvy. In the opinion of the author "it seems hardly possible that this ratio is entirely fortuitous. If further tests establish it as the true difference between tooth and general body requirements it will be a simple matter to convert antiscorbutic values that have been reported since the general adoption in this country of the Sherman method into tooth protective values. We will need only to multiply by two. What the true values are in terms of teeth obviously requires much more extended study. I believe, however, that the results reported herewith justify considerable faith in the Hütter method and its speed, its relative simplicity, its greater freedom from the danger of contaminating disease factors in the longer test all commend it to our careful appraisal."

Some simple extractors for the continuous extraction of small quantities of fluid, R. M. HILL and P. J. FRYAR (*Jour. Chem. Ed.*, 6 (1929), No. 12, pp. 2231–2233, figs. 4).—Four pieces of apparatus of a design sufficiently simple to permit of their construction in the laboratory from ordinary stock glassware are described and illustrated. The pieces described are intended, respectively, for extraction liquids (1) lighter and (2) heavier and both of higher boiling point than the liquids to be extracted, and for extraction liquids (3) heavier and (4) lighter and both of lower boiling point than the liquid to be extracted.

An electron tube potentiometer for the determination of pH with the glass electrode, W. C. STADIE (*Jour. Biol. Chem.*, 83 (1929), No. 2, pp. 477–492, figs. 5).—Pointing out the serious restriction of the usefulness of the glass electrode, otherwise often very valuable, by the high internal resistance of the glass cell which has heretofore necessitated the use as a null point instrument of the troublesome quadrant electrometer (in place of the usual galvanometer), the author describes a potentiometric system stated to be easily controlled, sensitive, and stable in summary form as follows:

"The grid, filament, and plate circuits of two electron tubes (No. UX 222) are connected in parallel. The plate circuits are arranged as a Wheatstone bridge which may be balanced by variable resistances allowing a high sensitivity galvanometer to be inserted into the plate circuit. The e.m.f. of a glass cell in the grid circuit of one tube may then be measured to 0.001 volt or less. The apparatus is free from electrostatic disturbances and is very steady in its action. In measuring e.m.f. through resistances of 20 to 600 megohms its sensitivity is 1 to 4 mm. of deflection per 0.001 volt."

The effect of pH upon the precipitation of zinc ammonium phosphate, T. R. BAIL and M. S. AGRUSS (*Jour. Amer. Chem. Soc.*, 52 (1930), No. 1, pp. 120-124, fig. 1).—The results of this study indicate a definite influence of the pH value upon the precipitation of zinc as zinc ammonium phosphate by the addition to the zinc solution of diammonium phosphate in the presence of added ammonium chloride. Satisfactory results could be obtained at pH values within the range pH 6.4 to 6.9, the best at pH 6.6. Above pH 7 the precipitate was not crystalline and could be removed from the beaker only with difficulty. Sodium acetate was added in quantity sufficient to secure adequate buffer action, as without the addition of sodium acetate pH values as low as 6.3, a figure found to be dangerously low, could occur.

Between 5 and 10 gm. in 150 cc. variation in the concentration of ammonium chloride appeared to be without appreciable effect upon the precipitation.

A general method for the determination of halogens in organic compounds, J. J. THOMPSON and U. O. OAKDALE (*Jour. Amer. Chem. Soc.*, 52 (1930), No. 3, pp. 1195-1200, figs. 2).—In principle, the method detailed in this contribution from the University of Michigan consists in the oxidation of the halogeniferous substance either by fuming sulfuric acid alone or with this oxidant supplemented by chromic acid or by a persulfate, with the distillation of the free halogen into excess of sodium arsenite solution. Special apparatus for the method is described, and two slightly different procedures, the one especially adapted to the determination of iodine, the other for the analysis of chlorine or bromine compounds, are given.

The use of this method was found to make readily possible, also, the determination of any arsenic, antimony, or bismuth contained in the halogeniferous sample analyzed.

Micro-determination of sulfur by fusion, H. EMERSON (*Jour. Amer. Chem. Soc.*, 52 (1930), No. 3, pp. 1291, 1292).—Oxidation by fusion with potassium nitrate and sodium carbonate was found adaptable for use as a micro method.

Prepare the fusion mixture by powdering 3 parts by weight of potassium nitrate with 4 parts of sodium carbonate. Mix thoroughly a sample containing about 0.5 mg. of sulfur with about 100 times its weight of the fusion mixture in a 20-cc. nickel crucible, covering the reaction mixture with the pure fusion mixture to prevent loss. Close the crucible with a well-fitted cover, place the nickel crucible in a porcelain crucible of suitable size, and heat at first with a very low Bunsen burner flame. Increase the heat gradually during 10 minutes to maximum, hold at this heat for 15 minutes, and after cooling, dissolve the contents of the crucible in 5 cc. of water and filter into a 30-cc. beaker. Wash the crucible and filter with 10 cc. of water, acidify with hydrochloric acid, and heat to boiling, precipitate the sulfate with 1 cc. of 10 per cent barium chloride, and weigh, after not less than one hour's standing, on a micro Neubauer crucible.

The results given indicate a satisfactory degree of accuracy.

The rapid determination of sulfur in organic compounds, E. WETHEIM (*Jour. Amer. Chem. Soc.*, 52 (1930), No. 3, pp. 1075-1078).—Essentially the

procedure described in this contribution from the University of Arkansas consists in carrying out the combustion in a Parr bomb and determining the sulfate ion in the solution of the oxidate by means of a modification of the Wildenstein volumetric method. Carbon dioxide and hydrogen peroxide are removed from the solution containing the sulfate, and a standard solution of potassium chromate is added until tests with ferrous thiocyanate used as an external indicator match a "standard end point"; a known quantity of barium chloride in excess of that required to precipitate the sulfate is added; and the excess barium is titrated with the standard chromate solution to the same standard end point to which the solution was brought before precipitation of the sulfate.

The indicator consisted of potassium thiocyanate 1 gm., ferrous sulfate 1.5 gm., water 50 cc., and 1:1 hydrochloric acid 15 drops. Any color appearing in the indicator could be discharged by sodium hyposulfite ($\text{Na}_2\text{S}_2\text{O}_4$; not sodium thiosulfate), of which any excess over that required to decolorize must be avoided.

The testing solution was made from 10 drops of the standard chromate solution plus 100 cc. of water, and of this testing solution 4 drops added on a spot plate to 2 drops of the indicator constituted the standard end point to which reference has been made above. Results agreeing very closely with the gravimetrically determined check values and with the theoretical figures were obtained with sulfonamides, sulfones, sulfoxides, allyl thiourea, etc.

Determination of sulfur in liquid organic compounds, E. WERTHEIM (*Jour. Amer. Chem. Soc.*, 52 (1930), No. 3, pp. 1088-1088).—The author describes in some detail a modification of the Klason method. By using air in place of oxygen for the combustion, flashing during the burning of the sample was found to be avoidable; and chips of Pyrex glass showed themselves so nearly as effective as the platinum catalyst that the glass was used.

Figures from volumetric determinations involving the titration described in the preceding abstract and from gravimetric determinations of the sulfate resulting from oxidations carried out according to the modified procedure are given for a fair variety of liquid organic sulfur compounds, and indicate a rather close agreement with the theoretical sulfur content of the substances analyzed.

The relation between cystine yield and total sulphur in various animal hairs, C. RIMINGTON (*Biochem. Jour.*, 23 (1929), No. 4, pp. 726-729).—Using the Sullivan method for the determination of cystine, the author was able to account as cystine for very nearly the entire sulfur content of dog hair (white Samoyed), rabbit fur (white Angora), white alpaca tops, two samples of camel hair tops, a wool sample, and a sample of Tunisian goat hair. In the case of the camel hair the sulfur accounted for as cystine was less than 95 per cent of the total sulfur, a discrepancy held to be outside the range of experimental error. In the remaining cases the discrepancy was less than 1.4 per cent of the total sulfur.

A new process for the manufacture of a new type of chlorinated lime [trans. title], A. CAVUGHI and C. PAOLONI (*Gior. Chim. Indus. ed Appl.*, 12 (1930), No. 1, pp. 9-13, fig. 1).—Description is given both of the laboratory and of the commercial form of the process for preparing either anhydrous crystalline or hydrous crystalline chlorinated lime, the essential feature of the method being the treatment with chlorine of a suspension of hydrated lime in carbon tetrachloride.

The manufacturing reaction was carried out in revolving drums at a temperature above 40° C., yielding an amorphous hydrous product; the reaction

mixture was cooled below 20° to effect crystallization; and desiccation was begun by a distillation under reduced pressure at 20 to 30° in which the carbon tetrachloride was recovered. Desiccation was completed by further treatment under reduced pressure.

Advantages claimed for the anhydrous chlorinated lime obtained by this method include rapid solution and high solubility in water, a hygroscopicity lower than that of the usual form of this product, the absence of odor, and a much improved stability.

METEOROLOGY

Report of the chief of the Weather Bureau, 1928-29 (*U. S. Dept. Agr., Weather Bur. Rpt. 1929, pp. V+250, pls. 7*).—In addition to brief comments on aeronautical meteorology, weather reports at sea, and frost and fire weather warnings, this report gives a general summary of weather conditions of each month of 1928, brief summaries of data regarding tornadoes, hail, losses from windstorms, sunshine, and excessive rainfall during the year, and detailed tabulations of data for pressure, temperature, precipitation, humidity, cloudiness, wind, and evaporation throughout the United States.

It is stated that "the outstanding events of the year from the weather standpoint were the severe hurricanes of August and September that visited the southeastern sections." As a result of these storms "the precipitation over the States or portions of the States affected was in many instances the greatest of record for the two months. Other important events of the year were the coolness of April over many districts and the unusual snowfalls for the same month in certain areas. The year was, on the whole, one of moderate temperatures over most districts, and no drought threatened any large portion of the great food-producing areas."

Climatological data for the United States by sections, [September-October, 1929] (*U. S. Dept. Agr., Weather Bur. Climat. Data, 16 (1929), Nos. 9, pp. [199], pls. 3, figs. 3; 10, pp. [200], pls. 3, figs. 5*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for September and October, 1929.

Meteorological observations (Maine Sta. Bul. 349 (1928), pp. 181, 182).—Observations at the University of Maine on temperature, total precipitation, snowfall, cloudiness, and wind during 1928 are briefly summarized by months. The mean temperature, total precipitation, and snowfall for the 60 years of continuous observation at Orono are also given. The mean temperature of the year was 44.52° F., as compared with a 60-year mean of 42.67°. The total precipitation was 45.95 in., as compared with the 60-year mean of 41.67 in. The snowfall was 52.6 in., as compared with the 60-year mean of 85.7 in. The number of cloudy days was 89.

Meteorological observations, [November-December, 1929], C. I. GUNNESS and D. F. MURPHY (*Massachusetts Sta. Met. Ser. Buls. 491-492 (1929), pp. 4 each*).—The usual summaries are given of observations at Amherst, Mass., during November and December, 1929. The December number gives an annual summary, from which the following data are taken:

Mean pressure 29.938 in.; mean temperature 47.6° F., highest 97° September 4, lowest -11° January 16; total precipitation 40.96 in., snowfall 54 in.; mean cloudiness 52.3 per cent, bright sunshine 42.9 per cent; last frost in spring May 23, first in fall September 19; last snow April 22, first November 21.

The climate of Ohio, W. H. ALEXANDER and C. A. PATTON (*Ohio Sta. Bul. 445 (1929), pp. 69, pl. 1, figs. 9*).—This bulletin, which replaces one on the same

subject previously noted (E. S. R., 27, p. 211) and brings the data down to the end of 1928, gives summaries of available observations on temperature, precipitation, snowfall, humidity, evaporation, sunshine, wind, and frost for the State as a whole and for the experiment station at Wooster and the experiment farms. It is stated that "the tabular matter amply substantiates the claim that Ohio, from an agricultural standpoint, is peculiarly favored in that the climatic elements are so stable and depart so little from the average or normal that complete failures of indigenous crops over a considerable portion of the State are infrequent."

Climate of Mexico, J. L. PAGE (*U. S. Mo. Weather Rev., Sup. 33* (1930), pp. [1]+80, figs. 41).—This account, based on observations compiled at the Central Meteorological Observatory at Tacubaya, Mexico, and on published descriptions of certain phases of the climate, shows Mexico to have a wide diversity of climatic conditions. "In temperature it ranges from hot, humid conditions of the tropical lowlands to permanently snowcapped heights. In mean annual rainfall it varies from 55 to 4,638 mm. Some places are said to receive no rainfall in some years. The number of days with rainfall varies from 15 to more than 200."

A bibliography of 72 references to the literature of the subject is given.

Conference of Empire Meteorologists, 1929, Agricultural Section.—I, Report. II, Papers and discussions (*London: Min. Agr. and Fisheries, 1929, vols. 1, pp. 16; 2, pp. 308. pls. 4, figs. 6*).—This is a full account of proceedings, papers, discussions, and resolutions of the agricultural section of the Conference of Empire Meteorologists, previously noted (E. S. R., 62, p. 401.)

The subjects of the papers presented and discussed were: Agricultural Meteorology: A Brief Historical Review (pp. 3-13), and Ten Points of a Weekly Calendar (pp. 14-20), both by N. Shaw; Agricultural Meteorology in Its Plant Physiological Relationships, by V. H. Blackman (pp. 21-33) (see p. 612); The Varietal Response of the Plant to the Length of Day, by M. A. H. Tincker (pp. 34-39) (see p. 612); Note on the Relation Between Weather and Crops, by A. Walter (pp. 40, 41); Climate, Crops, and Soils in British Tropical Colonies, by F. J. Martin (pp. 42-56); Weather and Tobacco, by A. J. W. Hornby (pp. 57-66); Methods for the Photo-Electric and Photo-Chemical Measurement of Daylight, by W. R. G. Atkins and H. H. Poole (pp. 67-94); Meteorological Research and Fruit Production, by H. V. Taylor (pp. 95-114) (see p. 612); Meteorological Research and Fruit Production, by J. Turnbull (pp. 115-120); The Relation of Animal Numbers to Climate, by C. Elton (pp. 121-129); Weather and Climate in Their Relation to Insects, by B. P. Uvarov (pp. 130-147) (see p. 613); The Relations of Entomology to Meteorology, by J. J. de Gryse (pp. 148-167) (see p. 613); The Relation of Weather to Plant Diseases, by C. E. Foister (pp. 168-219) (see p. 612); Crop Forecasting and the Use of Meteorological Data in Its Improvement, by J. O. Irwin (pp. 220-276) (see p. 613); Crop and Weather Data in India and Their Statistical Treatment, by S. M. Jacob (pp. 277-298); and Weather and Wheat Yields at Lincoln College, New Zealand, by E. Kidson (pp. 299-306).

The report (vol. 1) is signed by N. Shaw and W. R. Black.

British agricultural meteorological scheme.—Observers' handbook (*London: [Govt.], (1929), pp. 34, pl. 1, figs. 5*).—This scheme, prepared "by the Agricultural Meteorological Committee acting for the Ministry of Agriculture and Fisheries, the Department of Agriculture for Scotland, and the Meteorological Office" and published as a part of the report of the Conference of Empire Meteorologists, 1929, agricultural section, provides for an orderly system of meteorological, crop, and phenological observations designed to ascer-

tain the effect of weather on crop growth, which has been put into effect at a number of stations in England, Wales, and Scotland. An especially significant feature of the scheme is the provision for meteorological observations in close proximity to the growing plants.

The records provided for "relate on the one hand to meteorological conditions and on the other to the progress and yields of agricultural and horticultural crops. To assist this scheme further, observations on wild flora and fauna have also been specified." The crops on which observations are to be made include wheat, barley, oats, turnips, swedes, meadow hay, apples, plums, black currants, and peas. A form of phenological study recommended provides for observations on plants from a common stock grown under uniform conditions in small gardens. "Summaries of all the observations taken under the scheme are issued monthly by the Ministry of Agriculture and Fisheries in the 'Monthly Agricultural Meteorological Report.'"

Agricultural meteorology in its plant physiological relationships, V. H. BLACKMAN (In *Conference of Empire Meteorologists, 1929, Agricultural Section. London: Min. Agr. and Fisheries, 1929, vol. 2, pp. 21-33, fig. 1*).—From his review of this subject, the author reaches the general conclusion that "the ordinary meteorological data of temperature and humidity are adequate for plant physiological purposes, though soil temperatures and humidity as well as air temperatures are required for the fuller study of the plant's reaction to these climatic factors. With regard to light, what is required is a measure of total radiation or, what would be still better, some measure of brightness and its variation during the day. The plant is certainly affected by light quality as well as light intensity, so that as our knowledge increases there will be need for a record at different localities of the energy distribution throughout the spectrum and its changes during the day."

The varietal response of the plant to the length of day, M. A. H. TINCKEE (In *Conference of Empire Meteorologists, 1929, Agricultural Section. London: Min. Agr. and Fisheries, 1929, vol. 2, pp. 34-39*).—The author reviews studies with wheat and soybeans, from which he concludes that "the genetical constitution of the early wheats is such that they can manufacture the necessary carbohydrate material for flower production under short light periods, and that the fact that English varieties are late when planted in Australia, and vice versa, depends largely upon the constitution of the varieties; further, that the cooler, moister conditions of Wales generally retard maturity. . . . Although soybeans are short-day plants, the early and late varieties respond somewhat differently to varying light periods."

An extensive bibliography is given.

Meteorological research and fruit production, H. V. TAYLOR (In *Conference of Empire Meteorologists, 1929, Agricultural Section. London: Min. Agr. and Fisheries, 1929, vol. 2, pp. 95-114, figs. 2*).—Weather and other factors (nitrogenous and potash fertilizers, grass cover, etc.) and fruit soil surveys are discussed. With regard to protection against frost damage, it is stated that in England "the high cost of orchard heating and the uncertainty surrounding frost occurrences make it necessary for growers of deciduous fruits to rely more and more on what may be termed frost resistant varieties, and it is to this aspect that the attention of research investigators is directed more particularly."

The relation of weather to plant diseases, C. EL. FOISTER (In *Conference of Empire Meteorologists, 1929, Agricultural Section. London: Min. Agr. and Fisheries, 1929, vol. 2, pp. 163-219*).—The literature of this subject is reviewed

with an extensive bibliography, and ways in which the meteorologist can be of assistance to the plant pathologist are suggested.

It is stated that the following meteorological data are required for each important crop plant: "(1) Air temperatures, (a) above the crop, (b) at the level of the top of the crop, (c) at mid-crop height, (d) at the base of the plants, and (e) in the soil. The temperatures should be recorded every 2 or 3 hours during the whole 24-hour period, or better still by a continuous method. (2) The moisture content of the land, (a) bare, near the crop, and (b) under the crop; the usual precipitation records, measured twice daily and nightly. (3) The relative humidity of the air, (a) above the crop, (b) at the level of the top of the crop, (c) at each quarter of its height within the crop, and (d) at the base of the crop. That just over bare land is also required. The records should be taken every 3 hours, day and night, or preferably continuously. (4) Cloud records and sunlight intensity; also relative penetrations of sunlight, clear and shaded, into the crop plants, for each degree of density and height of the plants in the crop. (5) The relative penetration of precipitation into a crop, at each degree of density, and the length of time moisture remains on the foliage. (6) The relative amounts of dew deposition in crops, at different heights in the crop, and for each state of temperature, moisture, and humidity as well as of crop density. (7) The relative penetration of wind of varying degrees of force into the crop, and its relation to crop humidity, temperature, and spore dispersal. (8) The humidity and temperature of the higher air strata (100-15000 ft.). (9) More information relative to air currents and spore dispersal."

The relations of entomology to meteorology, J. J. DE GRUYSE (In *Conference of Empire Meteorologists, 1929, Agricultural Section. London: Min. Agr. and Fisheries, 1929, vol. 2, pp. 148-167*).—A review of work done in Canada is stated to indicate "the paramount importance attached to meteorological phenomena in the study of economic insects." The necessity for extreme precision in measuring the effect of the physical factors on delicate organisms is emphasized. It is stated that "close cooperation between biologists and meteorologists would necessarily lead to improved results."

Weather and climate in their relation to insects, B. P. UVAROV (In *Conference of Empire Meteorologists, 1929, Agricultural Section. London: Min. Agr. and Fisheries, 1929, vol. 2, pp. 130-147*).—From a survey of the subject the author concludes that "there is a vast number of entomological problems which can not be solved without the friendly help of meteorologists, and it is to be hoped that a close cooperation between these two sciences will rapidly develop in the immediate future."

An extensive bibliography is appended.

Crop forecasting and the use of meteorological data in its improvement, J. O. LAWIN (In *Conference of Empire Meteorologists, 1929, Agricultural Section. London: Min. Agr. and Fisheries, 1929, vol. 2, pp. 220-276*).—In this article an account is given of official methods of crop forecasting in England and Wales, the United States, and India and of scientific studies having as their object the improvement of crop forecasting on the basis of meteorological factors. It is stated that "statistical technic is now competent to eliminate the effect of weather and leave the ground clear for the examination of any other factors which may be important," but that very considerable improvements, particularly in crop data and to a less extent in meteorological data, are still needed. The value of such data as applied to insurance, trade, administration, and other purposes is indicated.

SOILS—FERTILIZERS

[Soil and fertilizer notes] (*Texas Sta. Rpt. 1928, pp. 15, 16, 50-53, 61, 67, 117*).—These pages of the report contain the following soil and fertilizer items, not previously noted.

Nitrification.—Certain soils failed to nitrify added ammonium sulfate, although the soils were not acid before or after the test. In some of the soils the nitrification of the soil nitrogen itself was lessened. The work is attributed to A. J. Sterges.

Rotation and fertilizer work, main station.—"The yield of cotton was increased 14 per cent and the yield of corn 47.5 per cent, in comparison with the yield of continuous cotton and continuous corn, respectively. Manure was the most profitable treatment for cotton, which made an average yearly profit of \$6.36 per acre. . . . Superphosphate and rock phosphate were equally effective in increasing yields, but the latter was more profitable because it was cheaper. The removal of crop residues (cotton stalks and corn stalks) for a period of 14 years has not produced a significant decline in the productiveness of the soil."

Fertilizer experiments at Angleton, Beeville, College Station, Denton, Nacogdoches, and Troup.—Fertilizer formula trials of the usual type and of local application are here reported.

Soil fertility and moisture conservation studies at Lubbock and Spur.—Cropping system comparisons, principally of local significance, are noted. Yield increases at the Lubbock Substation from fallowing and green manuring did not appear sufficient in the 13 years of the test to justify the practice.

Chemical and microbiological studies in relation to the productiveness of soil.—Continuous cotton and corn depressed the soil nitrate concentration, but appeared not to affect the nitrifying power. Soil treated with nitrogenous materials not only contained more nitrates but had also the greater nitrifying power. Cotton yields correlated significantly both with the soil nitrate concentrations and with the nitrifying power, but the corn yields correlated with nitrifying power only, not with nitrate concentrations under the growing crop.

Composting raw phosphate rock and sulfur with different soils.—Sulfur applications of from 50 to 10,000 lbs. to the acre have shown no gain at Angleton, Beeville, College Station, Nacogdoches, Temple, and Troup. In general the sulfur had no effect up to 1 ton to the acre, but slightly reduced yields when applied at higher rates. On one soil sulfur treatments amounting to from 250 to 500 lbs. to the acre slightly reduced the yields of cotton, of corn, and of cowpeas.

Run-off water losses in relation to crop production.—Of the effective rainfall, 3.7 in. was lost from land of a 2 per cent slope, with a concomitant loss of about 3 tons of soil from each acre with each inch of water lost. Grass showed itself the crop most effective in conserving soil and water, and milo was more effective than cotton.

Fertilizer work under the Chilean Nitrate of Soda Fellowship.—The yield of lint cotton was found by the Nacogdoches Substation to increase with sodium nitrate applications up to 200 lbs. of the fertilizer to the acre. Beyond this rate of application the cotton yields fell off as nitrate additions were increased. Findings with respect to potassic and phosphatic fertilizer rates are also noted.

Potash experiment (South Carolina Sta. Rpt. 1929, p. 112).—Potash fertilizer tests of the usual type with cotton on a light soil at the Sand Hills Substation, very low in available potash, showed large increases in yield to have resulted from the application of 50 lbs. to the acre of potassium chloride. Late side dressings with this fertilizer were less effective than were earlier treatments.

[Fertilizer recommendations for important crops of the agricultural regions of North Carolina], C. B. WILLIAMS, H. B. MANN, and A. S. CLINE (*North Carolina Sta. Agron. Inform. Circa.* 34 (1930), pp. [1]+4, figs. 2; 35, pp. [1]+6, figs. 2; 36, pp. [1]+7, figs. 2; 37, pp. [1]+8, figs. 2; 38, pp. [1]+11, figs. 2; 39, pp. [1]+5, figs. 2; 40, pp. [1]+8, figs. 2; 41, pp. [1]+5, figs. 2).—Fertilizer recommendations for specific crops and of local application are separately given for each of eight regions into which the State has been divided for soil treatment purposes. Specific liming recommendations are not included in these circulars, although it is noted that for most legumes, and in many cases for tobacco, liming would be required.

Protein experiments (*South Carolina Sta. Rpt.* 1929, pp. 44, 45).—The progress of analyses for nitrogen and moisture in a number of crops with the view of relating fertilizer treatment to protein content is reported. The tentative conclusion is put forth that the protein content of some plants can be increased by fertilizer treatment, and that heavy liming apparently decreased the protein content of such crops as oats and rye is stated.

Iodine fertilization of plants (*South Carolina Sta. Rpt.* 1929, p. 45).—Potassium iodide and potassium iodate were applied at rates supplying from 1.5 to 3 lbs. of iodine to the acre, as was also 400 lbs. of sodium nitrate containing 0.054 per cent of iodine, amounting to 0.22 lb. of iodine to the acre.

The results were not found entirely consistent, but they were taken to indicate that the iodine content of plants can be increased by such fertilizer treatment, the iodine content having been found to be doubled in some instances. Iodine in pot experiments, however, showed a toxic effect when applied at the rate of 3 lbs. to the acre.

AGRICULTURAL BOTANY

An apparatus for the growth of plants in a controlled environment, A. R. DAVIS and D. R. HOAGLAND (*Plant Physiol.*, 3 (1928), No. 3, pp. 277–292, figs. 6).—In view of the fact that workers on similar problems often find difficulty in obtaining duplicate or comparable results on account of the lack of adequate control of some environmental influence, the authors have attempted to develop an apparatus that would permit efficient environmental control without necessitating a large maintenance fund and that would at the same time meet the requirements for any desired expansion. It is stated that the resulting apparatus, though satisfactory, is not designed for extensive growth investigations where large numbers of plants are involved and where a soil culture medium is employed. A description is given of the apparatus permitting the growth of plants under controlled conditions of light, temperature, humidity, and culture solution. This apparatus is constructed in units, making possible easy expansion with enlargement of research program and budget. The data are said to show the feasibility of establishing an environment which can be duplicated at will. Such a controlled environment permits the isolation of a single variable and a quantitative study of diverse physiological phenomena.

Constant temperature and humidity chambers, J. JOHNSON (*Phytopathology*, 18 (1928), No. 2, pp. 227–233, figs. 4).—The author describes a set of air-control chambers suitable for conducting experiments on the relation of environment to plant disease. These are said to have been in operation for five years, with but few repairs, and to have given satisfaction in experimental work, which is indicated (*E. S. R.*, 57, p. 744).

Apparatus for the determination of carbon dioxide in the respiration of apples, P. L. HARDING, T. J. MANEY, and H. H. PRAGGE (*Science*, 70 (1929), No. 1805, pp. 125, 126, fig. 1).—A respiration chamber of low cost is described as adapted to the handling of samples in bulk or quantity.

The extraction and separation of chlorophyll ($\alpha + \beta$), carotin, and xanthophyll in fresh green leaves, preliminary to their quantitative determination, F. M. SCHERTZ (*Plant Physiol.*, 3 (1928), No. 2, pp. 211-216).—A method is described for extracting the chlorophyll pigments, which are to be quantitatively determined by methods described below.

The quantitative determination of chlorophyll, F. M. SCHERTZ (*Plant Physiol.*, 3 (1928), No. 3, pp. 323-334, figs. 2).—In view of the fact that no one of the many methods heretofore offered for determining chlorophyll quantitatively has been generally adopted, the author has herein submitted his methods, attempting to place the estimation of chlorophyll on a sound basis for the comparison of data in work by different contributors. A brief description is given of the more important methods heretofore in use. Methods for determining chlorophyll colorimetrically and spectrometrically are described, and graphs are given from which quantitative data may be computed. The colorimetric method is said to be more accurate at concentrations of about 0.05 gm. per liter, while the spectrometric method is more accurate at concentrations of from 0.1 to 0.15 gm. per liter. On account of the instability of saponified chlorophyll, the chlorophyll solutions which have been saponified with methyl alcoholic potash should not be allowed to stand long before their pigment content is estimated. Though complete data for the spectrophotometric method are yet to be obtained, this method is thought to offer promise of being very accurate.

Osmotic pressure, osmotic value, and suction tension, W. A. BECK (*Plant Physiol.*, 3 (1928), No. 4, pp. 419-440, figs. 2).—Holding that the term "osmotic pressure" has been widely misapplied to various osmotic quantities in plant physiology, particularly before Ursprung began to conduct or assist relevant, critical examinations, some results of which have been noted (E. S. R., 42, pp. 228, 334; 44, p. 824), and claiming that the use of the term osmotic pressure does not necessarily imply the kinetic theory, the author defines the term as the difference of pressure on solution and solvent which produces a condition of equilibrium.

"The osmotic value of a given cell sap is the molal concentration of an agent which is in dynamic equilibrium with the cell sap. . . . For each osmotic value there is an equivalent suction tension of the cell sap. . . . The isosmotic coefficient of a salt is the number in the series established by De Vries, which expresses roughly the osmotic activity of the substance, and the degree of dissociation. The osmotic coefficient of a salt is the ratio of the osmotic value of a cell sap, in terms of cane sugar, to the osmotic value of the same, in terms of the given salt. . . . The osmotic value of a cell may change under the influence of external factors. The osmotic value of neighboring cells need not be the same, even though they belong to the same tissue. The average value for a given tissue is characteristic for that tissue. No regular gradient of O_2 could be established in the direction of the streaming of the water in the plant.

"The suction tension of a cell represents the positive or negative pressure which causes the influx of the water into the cell. The use of the term does not imply that the hydrostatic theory is adhered to. This term should be used instead of Ursprung's 'suction force.' The numerical value is given by Ursprung's law which states that the suction force of a cell equals the suction force of the contents of the cell less the wall pressure. . . . There is a suction-tension gradient in the direction of the streaming water in the plant. The suction tension is influenced by external factors. The moisture of the soil and the relative humidity of the air are the most important. The suction tension of the root hairs may be used as an indicator for determining the rela-

tive resistance which soils offer to the influx of water into the plants. The suction tension of plants depends upon the habitat."

Soil moisture at permanent wilting of plants. F. J. VETHEMEYER and A. H. HENDRICKSON (*Plant Physiol.*, 3 (1928), No. 3, pp. 355-357).—In extensive experiments extending over a period of years, the authors have observed a remarkable constancy of the residual moisture content for a given soil when permanent wilting is attained under widely varying conditions as regards evaporation, the trials indicated seeming to support the view that on a given soil all plants reduce the moisture content of the soil to about the same extent up to the attainment of permanent wilting. In an earlier report (E. S. R., 60, p. 721) they showed that with some soils remarkable agreement existed between the observed and the calculated wilting coefficient. However, later results with many soils are said not to have upheld the supposed correctness of the ratio (wilting coefficient = moisture equivalent : 1.84), and they do not believe that a common factor for all soils may be used to calculate the amount of water which remains in the soil at permanent wilting.

An account, with tabular data, is given of experimentation in which sunflower plants were grown in containers of two sizes under the varied seasonal conditions prevailing at Davis, Calif. From the data, though these show close agreement with the 1.84 ratio, it is concluded that the amount of water available for plant growth can not be determined from the moisture equivalent alone. The authors think that the moisture equivalent is the best single-value determination for interpreting the moisture properties of soils, but that it is not an exact measure of how much of that water is available to growing plants. "For accurate work it is evident that the amount of readily available moisture can be obtained only when the amount of residual moisture at permanent wilting is known, because it seems that plants are able to reduce the moisture content of different soils to different degrees of dryness before this stage of wilting is reached."

Changes in the buffer system of the wheat plant during its development. A. M. HURD-KARRER (*Plant Physiol.*, 3 (1928), No. 2, pp. 131-153, figs. 12).—Studies subsequent to those previously noted (E. S. R., 51, p. 651) and involving the complete titration curve have given a more comprehensive view of the changes which take place in the titratable compounds of the juice. The results show a remarkably ordered relation between the buffer capacity of the juice, its H-ion and "titratable-acid" concentration, and the developmental stage of the plants. As to method, the details of procedure were the same as previously outlined (E. S. R., 49, p. 245).

It is stated that the electrometric titration curve of juice expressed from wheat plants changes progressively during the seeding stage and during the maturation period. Only minor changes, correlated with environmental factors, occur during the tillering stage and most of the shooting stage. The differences in the form of the titration curve for juice of seedlings in successive stages of development indicate differences in composition associated with increasing photosynthetic activity to the end of the seedling stage.

Biochemical studies on seed viability.—I, **Measurements of conductance and reduction.** R. P. HIBBARD and E. V. MILLER (*Plant Physiol.*, 3 (1928), No. 3, pp. 335-352, figs. 2).—Previous work (E. S. R., 56, p. 627) having indicated a correlation between the electrical conductivity of seed extracts and seed viability, it was hoped that a broadening of this work with an improved method would support this conclusion. The present account reports further investigations along this line and others related thereto.

A review is given of the literature on the methods of testing, and a method claimed to be new and very simple is offered as useful for seed testing and for classifying seeds, but as to high, low, and medium viability only. It is not claimed to distinguish germination differences within 2 or 3 per cent. The method consists in determining the time rate of reduction in KMnO_4 solution in which the seeds are soaking. Proof is claimed to be furnished that the substance which reduces the KMnO_4 is not an enzyme, but that it may belong to the group of substances known as amino acids, peptides, and amides.

Germinative energy of lots of coniferous-tree seed, as related to incubation temperature and to duration of incubation, F. W. HAASIS (*Plant Physiol.*, 3 (1928), No. 4, pp. 365-412, figs. 15).—The results are presented of experimental studies on the germinative energy of seed lots, as the measure of this lot characteristic is influenced by the maintained temperature and by the length of the period of incubation employed in the experimental tests. The material used included, besides five lots of pitch pine (*Pinus rigida*), several seed lots of other coniferous species.

The main aim was to ascertain approximately for each lot of seed the optimal maintained temperature for the occurrence of germination corresponding to each length of incubation period tested, though some attention was given to the other cardinal temperatures also (minimal and maximal) and to the manner in which the form of the temperature-germination graph alters with the length of the incubation period. The temperatures and periods are detailed.

The phenomenon of a double maintained-temperature optimum (two different optima) for the occurrence of germination in a lot of seed is here reported, supposedly for the first time.

"A lot of seed may be classified in groups or categories, according to the different proportions of its individuals that are capable of germination under the influence of different sets of temperature and duration conditions." Details are given.

Chemical treatment to shorten the rest period of sugar maple trees, C. G. DEUBER and P. R. BOWEN (*Science*, 70 (1929), No. 1804, p. 102).—It is stated that in September, 1928, a little-known fungus disease of the leaves of *Acer saccharum* was found in southern Connecticut by F. A. Bartlett and the senior author. In an attempt by the present authors to force new leaves for a study of this fungus during the winter and spring, it was found that in January the 5-day treatment at a concentration of 20 cc. of ethylene chlorohydrin vapor to 121.5 liters of air space was the best, 55 per cent of the small trees producing leaves by February 28, while in no case did the untreated control trees produce leaves by March 15. This method made possible the complete study during that winter of the fungus and its effects on the host leaves.

Calcium, potassium, and iron balance in certain crop plants in relation to their metabolism, W. F. LOEWING (*Plant Physiol.*, 3 (1928), No. 3, pp. 261-275).—In view of observations cited, including some by the author (E. S. R., 55, p. 516), studies were undertaken to determine whether chemical analyses of crop plants in their vegetative phase would show why the fertility of certain poorly productive, acid muck soils was diminished by the use of calcium and potassium fertilizers. It is claimed that grain crops on acid muck soils low in potash are often injured by additions of calcium carbonate, which may entail potash hunger and consequent interference with carbohydrate storage or induce chlorosis by making sap too alkaline to maintain iron in solution. Additions of potassium chloride may injure grain plants by increasing iron accumulation in the tissue to the extent of toxicity, or by reducing the lime and magnesium content to the point of starvation. Sap is more acid in high potash

than in high lime tissues. Soil and sap acidity promote iron solubility and absorption. High yield in young grain plants was associated with high carbohydrates and high organic nitrogen, low yields being characterized by low protein, low carbohydrate, and high nitrate content.

Further evidence of the essential nature of zinc for the growth of higher green plants, A. L. SOMMER (*Plant Physiol.*, 3 (1928), No. 2, pp. 217-221, figs. 3).—In 1914 Mazé showed (E. S. R., 31, p. 221) zinc to be essential to the normal growth of maize. In 1926 the present author, with Lipman, showed (E. S. R., 61, p. 23) that zinc, as well as boron, is essential to normal growth of barley and of sunflowers. She used the same technic in the present work, adding to the plants already studied buckwheat, Windsor beans, *Vicia faba*, and red kidney beans. The importance of refined methods having been previously recognized (E. S. R., 58, p. 318), all salts were especially purified, the solution culture method was employed, and the plants were grown in Pyrex containers.

Buckwheat responded to the lack of zinc in a way similar to that shown by sunflowers, growing more slowly than the controls even in the early stages and at maturity averaging less than 25 per cent of the normal weight.

The response of the legumes was quite different. In the case of Windsor beans, no difference appeared until the flowering stage was reached, when a sudden and rapid abscission of the leaves occurred. Most of the flower buds fell off, and in the few seed pods that formed no seeds were present. The dry weight, on the average, of the Windsor beans grown without zinc was about half of that normally attained. Very similar results were obtained with red kidney beans.

The plants presented three types of response to zinc, which are described. From the fact that zinc has been proved indispensable in five different plant families, it is thought probable that this element is indispensable for all of the higher green plants.

Effects of the absence of boron and of some other essential elements on the cell and tissue structure of the root tips of *Pisum sativum*. A. L. SOMMER and H. SOROKIN (*Plant Physiol.*, 3 (1928), No. 3, pp. 237-260, pls. 5).—This account presents a portion of the work on the need of boron and certain other elements in connection with higher green plants as proceeding under the hands of the senior author (above noted), and as embodying a cooperative extension of that study as applied to the pathological changes which occur in the cells and tissues developed in a medium lacking boron, and, incidentally, lacking, successively, others of the elements usually supposed to be essential to plant growth.

It is shown that *P. sativum* grown in solutions lacking boron exhibits short, thick, and stunted roots. Plants grown in solutions lacking boron and certain other supposedly essential elements show pathological alterations roughly similar to those appearing in the absence of boron only. The enlargement of the root apexes is due to the hyperplasia of the plerome and hypertrophy of the periblem regions. The meristematic region of root tips grown without boron is abnormal, in that the cells cease dividing normally and existing cells undergo premature development or pathological changes, isolated xylem elements appearing in regions occupied by the meristem in normal roots or in the region of elongation. The primordia of the secondary roots begin to form abnormally close to the root tip, though these are usually soon suppressed.

Generally speaking, lack of boron causes a disturbance in the regulation of growth and development. The profound structural changes here observed indicate that physiological investigations of the various elements must be accom-

panied by morphological, histological, and cytological studies to attain their fullest significance.

Aluminum toxicity, F. T. McLEAN and B. E. GILBERT (*Plant Physiol.*, 3 (1928), No. 3, pp. 293-302).—Citations are given showing the differences in the views of various workers regarding the toxicity of aluminum to plants. The authors, having shown previously (*E. S. R.*, 58, p. 121) that plants differ in susceptibility to aluminum poisoning, have followed up their previous work, growing plants of different kinds in solution cultures to test both their susceptibility to aluminum injury and the efficiency of the phosphate radical as a preventive of such injury.

It is stated that soluble phosphate, in concentrations equivalent to that of aluminum, completely counteracts the toxicity of this element, which, even when in the nondiffusible, colloidal form, shows toxicity when in contact with barley roots. Aluminum as citrate is toxic even in solutions of low acidity (pH 6+). Aluminum is stimulating to plants at low concentrations, and toxic at higher ones.

Manganese toxicity in tobacco, H. G. M. JACOBSON and T. R. SWANBACK (*Science*, 70 (1929), No. 1812, pp. 283, 284).—In 1928 certain peculiar abnormal physiological symptoms appeared in tobacco plants in the greenhouse at the Connecticut State Experiment Station and at the Tobacco Substation. The soils appeared normal except for a high acidity and a correlated high content of soluble manganese. Tests described appear to have confirmed the correlation of the injury with high manganese and acidity. The manganese injury is described.

GENETICS

Genetics and improvement of economic animals and plants (In *Proceedings of 3. Pan-Pacific Science Congress, Tokyo, 1926*. [Tokyo: Natl. Research Council of Japan], 1928, vol. 1, pp. 1142-1196).—Papers of interest to geneticists presented at the third Pan-Pacific Science Congress, held in Tokyo October 30 to November 11, 1926, and detailed in these pages, included Experience in the Philippines with the Introduction of Pure Breed Animals to Improve the Common Stock, by B. M. Gonzalez (pp. 1142-1150); The Inherited Coat-Colour of Horses, with Reference to the Genetic Constitutions of Varieties of Bay, by K. Masui and S. Adachi (pp. 1150-1157) (*E. S. R.*, 62, p. 514); On the Hybrids of the Budgerigars, by N. Takatusukasa (pp. 1158, 1159); A New Case of Linkage in Silk-Worms with Special Reference to Multiple Allelomorphs, by S. Ogura (pp. 1159-1163); On the Voltinism of the Silk-Worm, by K. Watanabe (pp. 1163, 1164); Meta-Zenia or the Influence of the Male Parent on the Tissues of the Mother Plant Outside of the Embryo and Endosperm, Especially as Exemplified in the Date Palm, by W. T. Swingle (pp. 1164, 1165); Genetics in Relation to the Improvement of Important Crops and Rice in Particular—Pure Line Selection in Rice, by H. W. Jack (pp. 1166-1171); Natural Crossing in Rice and Its Relation to Rice Improvement, by N. B. Mendiola (pp. 1171-1179); The Present Status of Rice Improvement in Japan (pp. 1179-1185) and Occurrence of Mutation in the Rice Plant (pp. 1186, 1187), both by H. Terao; Genetics in Relation to the Improvement of Rice, by Y. Yamaguti (pp. 1187-1191); and Some Suggestions About Cotton Breeding in China, by T. H. Shen (pp. 1191-1196).

Evolution—Darwinism, Lamarckism, G. J. DE FEJÉRVÁRY (*Biol. Gen.*, 5 (1929), No. 4, pp. 501-540).—On the basis of a discussion of Keith's paper (*E. S. R.*, 58, p. 627), the author cautions against adopting either Darwin's or Lamarck's theories of evolution, but believes there is merit in certain features of the hypotheses offered by both individuals.

Chromosome behavior in *Triticum* hybrids [trans. title], K. SAX (In *Verhandlungen des V. Internationalen Kongresses für Vererbungswissenschaft, Berlin, 1927. Leipzig: Borntraeger Bros., 1928, vol. 2, pp. 1267-1284; abs. in Maine Sta. Bul. 349 (1928), p. 177; Ztschr. Induktive Abstam. u. Vererbungslehre, 46 (1927), No. 1, pp. 52, 53*).—In a cross of aegilops (14 chromosomes) and an emmer (14) there was no pairing of chromosomes, an observation of interest in connection with the possible origin of the wheat species. Crosses of aegilops and members of the *vulgare* group (21) were found to result in F_1 hybrids which are almost completely sterile. Seven chromosomes of the aegilops apparently were compatible with 7 of the *vulgare* chromosomes, which suggested that the *vulgare* group contains 14 chromosomes contributed by emmer and 7 contributed by aegilops, and supports the hypothesis that the *vulgare* wheats were derived from a cross of emmer with an aegilops.

Further genetical studies of *Aplocheilus latipes*, T. ADA (*Genetics, 15 (1930), No. 1, pp. 1-16*).—In continuing the genetical studies of crossing over between the X and Y chromosome in *A. latipes* (E. S. R., 48, p. 566), the two kinds of heterozygous males, X,Y_E and X_EY , were crossed with white females, X,X . From the former cross there were 8,023 normal offspring and 28 exceptional offspring (9 red females and 19 white males) produced. In the second cross there were 5,000 normal and 14 exceptional offspring (5 females and 9 males). Of the exceptional males, 7 were of the genetic constitution X_EX,Y , and therefore resulted from nondisjunction, while the other 2 were X,Y_E and resulted from crossing over. The crossover rate of the R gene from the Y to X chromosome was thus 1:300 and from the X to Y chromosome 1:1,200. The greater freedom of crossing over of the dominant gene from the Y to the X than from the X to the Y is suggested as the reason for assuming that the Y chromosome in other species is empty.

Matings of the 7 nondisjunctional red males, X_EX,Y , from the X_EY and X,X , cross with white females produced 996 red and 953 white females and 11 red and 8 white males. Of the 19 male offspring 16 from the 7 nondisjunctional males were tested, 1 being a normal XY male while the rest were secondary nondisjunctional offspring of the first nondisjunctional generation. The frequency of secondary nondisjunction increased in successive generations, so that in the third generation it was 10 times that in the first generation. Two recessive mutations involving a fusion of the vertebra and a waving of the vertebral column dorsoventrally are described. The genes for these factors were not linked with any known genes. Recessive individuals were less viable than normals.

The cytological expression of changes in gene alignment produced by X-rays in *Drosophila*, H. J. MULLER and T. S. PAINTER (*Amer. Nat., 63 (1929), No. 686, pp. 193-200, fig. 1*).—Reference is made to the agreement of the genetic evidence with the cytological picture in case of breakages in the X and second and third chromosomes of *D. melanogaster* by X-rays. When the genetic evidence has indicated their attachment to other chromosomes, the cytological picture of the chromosomes has shown such to be the case. On the other hand, chromosome distances indicated by crossover percentages agreed with the relative size of the chromosome fragments observed in microscopic studies, probably due to variations in the tendency to cross over in different regions.

An analysis of the effects of the different rays of radium in producing lethal mutations in *Drosophila*, F. B. HANSON and F. HAYS (*Amer. Nat., 63 (1929), No. 686, pp. 201-215, figs. 5*).—In experiments with *D. melanogaster* it was found that exposure of males to radium irradiation for nine hours induced the production of an increased number of lethal mutations. The per-

centage of lethal mutations was 13.6 when no filter was employed, but when lead filters were used the mutation rate was so decreased that with a filter 0.312 in. in thickness only 1 per cent of mutations was observed. The curve of the amount of ionization induced by the beta rays in the air chamber in which the flies were treated was found to be in close accord with the mutation rate. It was therefore concluded that the beta and not the gamma rays were the ones responsible for the induction of mutations.

Comparative frequency of defective seeds and chlorophyll abnormalities in different varieties of corn following self-fertilization. C. M. WOODWORTH (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 10, pp. 1007-1014).—Observations on a large number of self-fertilized ears of corn at the Illinois Experiment Station revealed that percentage of seed and seedling abnormalities varied greatly for the varieties studied, Illinois High Yield showing about three times the percentage shown by Reid Yellow Dent and Illinois Two Ear. A slight relation was apparent between the general appearance of the ears and the percentage of seed and seedling abnormalities, the better-appearing ears showing the smaller percentages. Entire absence of chlorophyll (albinism) was the most frequent chlorophyll defective type found and was followed in order by pale green, japonica, virescent, yellow, lineate, and fine striped.

Effect of smut infection on the yield of selfed lines and F_1 crosses in maize. L. R. JORGENSEN (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 11, pp. 1109-1112).—In F_1 crosses between lines of corn self-pollinated for eight or more generations at the Ohio State University, cooperating with the Ohio Experiment Station and the U. S. Department of Agriculture, smut-infected plants (366 paired comparisons), regardless of the location of the galls, yielded 50 per cent less than comparable smut-free plants. In 50 paired comparisons between inbred lines selfed for four generations, smutted plants (except where the smut occurred in the tassel) yielded 39 per cent less than comparable smut-free plants.

The problem of sterility in Indian crops and fruit trees. MAHBUB ALAM (*Agr. Jour. India*, 24 (1929), No. 5, pp. 293-314, pls. 4, figs. 4).—Recent investigations in India and elsewhere reviewed were concerned with sterility due to environmental agencies, as nutrition, light, humidity, and disease, and to the germinal agencies grouped into incompatibility and impotence.

An experimental study of hybrid vigor or heterosis in rats. E. A. LIVESAY (*Genetics*, 15 (1930), No. 1, pp. 17-54, figs. 18).—Data are presented on the weights of male and female rats from three different strains and the F_1 and F_2 crosses between them at 30, 50, 70, 90, and 150 days of age. In general the data show the effects of heterosis in that the average weights of the F_1 generations were heavier than either of the parent breeds. In the F_2 generation there was some recession in the average weight, which in one cross was near the average weight of the smaller strain used as one of the original parents. The 90-day weights were taken as a basis for analysis, and the means for males and females in each strain or cross, as well as the standard deviation and coefficient of variation, were compared. Aside from differences in the average weights and variability of the different strains, it was pointed out that the F_2 s and F_3 s were less variable than the parental strains.

The three parental strains were of the genetic constitutions: *CCppRRHHAA*, *OOPPrhhaa*, and *caPPRRhhaa*. Classification of the F_2 s according to genotype for the three pairs of factors C, H, and A furnished an opportunity to locate linkages between the weight factors and known color factors. The F_2 rats were also grouped by weights and the phenotypes and genotypes within each weight group tabulated. Both groupings failed to show any relationship of geno-

type or phenotype to weight, and further groupings according to the number of dominant genes present in the heterozygous and homozygous conditions did not show any relation to size. There was a small correlation between litter size and 90-day weight.

On the result of simultaneous gametic and environmental correlations in a segregating population, O. TEDIN (*Hereditas*, 12 (1929), No. 1-2, pp. 11-16).—Through calculation of the expected correlation in the F_2 generation in theoretical simple cases of quantitative inheritance with and without linkage, the author concludes that if the correlation within the pure lines crossed is not known, correlation in a mixed population gives no indication of genetic relationships. When the correlation in the pure lines is known, the correlation in the mixed population may demonstrate genetic correlation if it is reversed or considerably larger than the correlation in the biotype.

Formulae and tables for calculating linkage intensities, F. R. IMMER (*Genetics*, 15 (1930), No. 1, pp. 81-98, figs. 2).—From the method of calculating the probable error of crossover percentages described by Fisher,¹ the author has estimated the relative number of individuals required to obtain the same probable error with different percentages of crossing over when crossing over was estimated from a back-cross and from the F_2 generation by the product method. Tables are presented to facilitate the calculation of linkage intensities and their probable errors by the product method when linkage between characters in different phenotypic ratios in the F_2 generation is involved.

The rex rabbit, W. E. CASTLE (*Jour. Heredity*, 20 (1929), No. 5, pp. 192-199, figs. 4).—A study of the linkage relations between the gene for the rex type of fur (lacking guard hairs) and other genes showed that rex was inherited independently of the genes for agouti, chinchilla, yellow fat, intensity, extension, English, and Vienna. The author also notes the observance of two crossovers among about 40 back-cross young between the factors for yellow fat and albinism.

Linkage studies on castorrex rabbits, W. E. CASTLE (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 52 (1929), No. 1, pp. 53-60).—Studies showing the independence of the rex factor from the known linkage groups in the rabbit are reported, including F_2 data not given in the above article.

A postscript reports the occurrence of four crossovers between the factors for yellow fat and albinism among 51 back-cross individuals.

The rex rabbit and its genetics [trans. title], H. NACHTSHEIM (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 52 (1929), No. 1, pp. 1-52, figs. 12).—A study of the linkage relations between the rex factor and color factors located in six linkage groups indicated that the rex factor was independent of all of them, thus forming a seventh group. It is pointed out that rex rabbits do not appear to be as vigorous as normals at the younger ages. Although the birth weights of normal and rex rabbits born in the same litters were not significantly different, there was, during the first eight weeks, a 50 per cent mortality in rex rabbits as compared with about 20 per cent in normals. The normal rabbits made gains during this period of 597.3 ± 12.87 gm. as compared with 508.9 ± 15.31 gm. for the rex litter mates.

Attention is also called to the fact that rex rabbits seem to be more susceptible to various diseases, including colds, lung infection, tuberculosis, and rachitis.

The rex and normal rabbits differ in the time when the milk hair is shed, rex rabbits shedding at an earlier age and often before the adult fur appears, resulting in a nearly hairless individual.

¹ Statistical Methods for Research Workers, R. A. Fisher. Edinburgh: Oliver & Boyd, 1928, 2. ed., rev. and enl., pp. XI+269, figs. 12.

The author also mentions the appearance of another mutation, identical phenotypically with rex, which has been found to differ from rex genetically.

The genetics of the domestic fowl.—II, The genetics of leg feathering (*Jour. Heredity*, 20 (1929), No. 3, pp. 111-118, figs. 3).—In continuing this series (E. S. R., 61, p. 821) Dunn has abstracted, from a translation by Glessing, that portion of the publication edited by Koltzoff (E. S. R., 58, p. 29) dealing with the genetic factors for leg feathering. It is pointed out that new genes for heel tufts (susti) and recessive leg feathering (asuso) were described. The morphological distinction between the several types of leg feathering should be helpful in further studies of the inheritance of this condition. Further analysis of the gene for recessive leg feathering appears to be needed.

Rate of feather growth in Barred Plymouth Rock chicks, J. H. MARTIN (*Poultry Sci.*, 8 (1929), No. 4, pp. 167-183, figs. 5).—The results of a study at the Kentucky Experiment Station of the degree of feathering in Barred Plymouth Rock chicks at 30, 60, and 90 days after hatching are reported.

The data indicate that the rate of feathering in males is slower than that in females; 85.4 per cent of the females were well feathered or completely feathered on the back at 3 months, but only 69.3 per cent of the males were similarly feathered. Comparison at other stages also showed the more rapid feathering of females. The rate of feathering on the back was found to be closely related to the rate of growth.

A comparison of an exhibition stock with the production-bred stock from which the above data were obtained indicated that both growth rate and rate of feathering were slower in the exhibition stock. Study of the relations between the rate of back feathering and subsequent egg production indicated that these characteristics were correlated, and that the heavier layers—60 winter eggs or 150 eggs yearly—were all more completely feathered at 60 and 90 days than were the other groups. On the other hand, the quality of barring of slow feathering birds approached the standard for the breed more closely than that of rapidly feathering birds. There were few good layers among the birds showing desirable qualities of barring in the feathers.

Heredity and sex, J. H. SCHAFFNER (*Ohio Jour. Sci.*, 29 (1929), No. 1, pp. 1-26).—The author points out that a firm cytological basis has been established for explaining Mendelian heredity, but that there are only a few types in which the sex phenomena and chromosome phenomena coincide, and in many these are contradictory. The sexual states arising in organisms with sexuality are considered to be caused by the interaction of physiological and ecological conditions.

Sex dimorphism and variability in the appendicular skeleton of the Leghorn fowl, F. B. HURT (*Poultry Sci.*, 8 (1929), No. 4, pp. 202-248).—The results of a statistical study of the length of the normal leg and wing bones of 105 Leghorn fowls (53 females, 36 males, and 16 capons) are reported. The data showed that the bones of males were significantly longer than those of females, and that with few exceptions the ratios between the humerus and other wing bones and femur and other leg bones were greater in males than in females. There was, however, overlapping between the sexes in the range of absolute bone measurements and ratios. The bones of capons were in general longer than those of males, but the increase in size was greater in the leg than in the wing bones.

The effects of extracts of testis in correcting the castrated condition in the fowl and in the mammal, C. R. MOORE, T. F. GALLAGHER, and F. C. KOCH (*Endocrinology*, 13 (1929), No. 4, pp. 367-374, figs. 9).—The authors report success in isolating a lipid fraction from the testes of bulls, calves, hogs, and

sheep which will induce comb growth in capons, restore a certain amount of the loss of the secretory function of the seminal vesicles and prostate gland resulting from castration, and develop the histologically normal prostate and seminal vesicles in castrated rats.

Endocrine regulation of reproduction, O. RIDDLE (*Endocrinology*, 13 (1929), No. 4, pp. 311-319, figs. 3).—Evidence is cited to indicate that nearly all the internal secretions are intimately concerned either directly or indirectly with reproduction.

The ineffectiveness of vaginal smears in predicting the oestrous cycle in the rabbit, M. M. KUNDE and T. PROUD (*Amer. Jour. Physiol.*, 88 (1929), No. 3, pp. 446-452, fig. 1).—Studies of the vaginal smears of female rabbits showed an absence of the periodic recurrence of characteristic cell types associated with oestrus which has been observed in other rodents.

The inheritance of the ridgeling characteristic in Angora goats (*Texas Sta. Rpt.* 1928, p. 33).—In continuing these studies (E. S. R., 59, p. 726) the inheritance of cryptorchism in goats has been demonstrated beyond reasonable doubt. The 3 ridgeling bucks used produced 8 ridgeling and 9 normal sons, 6 ridgeling and 11 normal sons, and 4 ridgeling and 14 normal sons, respectively. Only 6.3 per cent of ridgeling sons have been produced during 4 years by non-ridgeling sires.

An inherited skull defect in swine, J. E. NORDBY (*Jour. Heredity*, 20 (1929), No. 5, pp. 229-232, figs. 3).—The author describes a type of skull defect in which there is incomplete development of the neural tube, involving the failure of the frontal and parietal bones to close completely. The prevalence of pigs showing this abnormality when there is close mating in the strain indicates that it is hereditary.

"High brow" albino rats, H. S. COLTON (*Jour. Heredity*, 20 (1929), No. 5, pp. 225-227, figs. 2).—The author describes the appearance of several rats having hydrocephalous skulls. Though this condition appeared in several individuals, it was not inherited in any simple manner.

Triplets in a relatively homozygous family, R. R. GATES (*Jour. Heredity*, 20 (1929), No. 5, pp. 209-212, figs. 4).—A set of triplet boys in a family of twelve is described. The triplets seem very similar, but on account of the similarity between the other sibs it is difficult to determine whether they are monozygotic, trizygotic, or monozygotic twins and a brother.

Order of birth of mental defectives, N. A. DAYTON (*Jour. Heredity*, 20 (1929), No. 5, pp. 219-224, figs. 2).—A study of the order of birth and size of family in which born of 10,455 retarded children in the Massachusetts public schools showed that the order of birth had little if any relationship to the birth of mentally defective children. The mentally defective children were born in slightly larger families (6.24 ± 0.03) than the retarded children (5.71 ± 0.04).

FIELD CROPS

[Field crops experiments in South Carolina] (*South Carolina Sta. Rpt.* 1929, pp. 20-32, 45-47, 76-78, 87, 88, 89, 99-101, 102, 103, 103-106, 108, 109, figs. 9).—Varietal trials with corn, oats, rye, wheat, barley, and winter legumes (E. S. R., 62, p. 33); fertilizer trials with corn, oats, wheat, peanuts, potatoes, sweetpotatoes, tobacco, and pasture; and cultural tests with corn, peanuts, and sweetpotatoes are again reported on from the station and substations (E. S. R., 60, p. 732). Awnless barleys, selected by the station, outyielded Tennessee Beardless and made only slightly less grain than Bearded Winter barley.

Oats on land that had been completely fertilized for and previously cropped with cotton responded markedly to a top-dressing of sodium nitrate. While the

phosphorus and potassium residue from the cotton fertilizer seemed to provide enough of these elements for oats, phosphorus and complete fertilizer also applied to the oats promised a consistent, if small, increase in yield. Oats top-dressed with different nitrogen carriers averaged from 33.5 to 39.1 bu. during 3 years, compared with 20.9 bu. from oats getting no nitrogen. The necessity for top-dressing oats with nitrogen early in the spring was very evident. While the increases in wheat yields usually produced by nitrogen were not nearly so large as with oats, superphosphate and complete fertilizer at planting were of greater benefit than on oats.

The average yield of corn rose consistently and proportionately to the quantity of nitrogen applied in side-dressing experiments, but no particular advantage appeared in supplying the dressing in two applications. In cooperative tests, higher yields were obtained from 200 lbs. of sodium nitrate applied when the corn was about knee high than at other growth stages. Corn yields were increased decidedly after leguminous winter cover crops, especially Austrian Winter field peas, and particularly when side dressed with ammonium sulfate. In a fertilizer-cultural test at the Pee Dee Substation the Williamson plan, wherein all fertilizer was applied relatively late, produced the highest yield, but this was only 0.2 bu. more than that on an adjoining plat receiving all fertilizer at planting.

Results in potato fertilizer trials showed the optimum formulas to differ according to conditions at the station and the Coast and Pee Dee Substations. Acre applications of 1.5 tons of 7-5-5 fertilizer returned the highest yields. Certified Irish Cobbler seed potatoes from many sources were practically equal in value.

Tobacco fertilizer experiments at the Pee Dee Substation suggested for the better soils drilling from 800 to 1,200 lbs. of fertilizer containing 10 per cent available phosphoric acid from superphosphate; 4 per cent of ammonia, one-half coming from high-grade organics, at least one-fourth from sodium nitrate, and the rest from urea or other standard inorganics; and 6 per cent potash from high-grade potassium chloride with either potassium sulfate or potassium magnesium sulfate, or both, but not containing more than 2 per cent of chlorine. Where sand drown occurs, up to 2 per cent of magnesia should be included in the formula. Bonanza, Jamaica, Cash, White-Stem Orinoco, Long Leaf Gooch, and Adcock have led the varieties.

Commercial fertilizers and ground limestone were applied to established pasture sod typical of the Piedmont. Points observed in 1929, the first year, were great stimulation in growth from a complete or a nitrogen fertilizer and a very slight increase over no treatment caused by potassium or phosphate fertilizers. A second and third application of nitrogen fertilizer during growth decidedly stimulated growth for a few weeks, although the effect of the treatment diminished rapidly, and near the end of the season the growth rate on all treated plats was about the same as on untreated plats. Limed and unlimed plats did not differ much in growth rate. During any period the growth rate was determined largely by the amount of rainfall. A very marked improvement in the growth and quality of grass at the Coast Substation was noted where low areas had been drained the previous year. Native lowland grasses were choked out by a good sod of carpet grass. Ridding pastures of underbrush by goats was quite satisfactory and economical.

[Field crops experiments in Texas] (*Texas Sta. Rpt. 1928, pp. 50, 53, 54, 58, 59, 62-66, 67, 91, 92, 95, 96, 98, 99, 100, 101, 102, 103, 106-108, 110, 112, 113, 115, 117, 118, 119, 120, 121, 126, 127, 130*).—Varietal trials with corn, oats, wheat, rice, grain sorghum, sorgo, broomcorn, potatoes, peanuts, alfalfa, soybeans,

cowpeas, sweetclover, winter peas, vetch, and miscellaneous grasses and legumes; cultural (including planting) tests with corn and grain sorghum; fertilizer tests with crops in rotation and rice; breeding work with wheat, oats, corn, grain sorghum, sorgo, peanuts, and rice; inheritance studies with corn (E. S. R., 61, pp. 216, 221) and grain sorghum; a production trial with high-nicotine tobacco; and crop rotations are reported on in these pages from the station and substations.

In general, rotation increased crop yields, its benefits being more pronounced in the Blackland region (E. S. R., 58, p. 531) than elsewhere in Texas. At the station a 4-year rotation of cotton, cowpeas, corn, and oats increased the yield of cotton 14 per cent and of corn 47.5 per cent over these crops continuously during 14 years. A 4-year rotation of corn, cotton, and peanuts at Angleton similarly increased the yield of cotton 5 per cent and of corn 85 per cent over 7 years. At Denton in the 4-year rotation of wheat, corn, spring oats, and clover, wheat again made the most marked increase, more than doubling the grain yield of continuous wheat. The yields of the other crops also were superior to those of continuous cultures.

During extended periods, hoed, uncultivated plats at Lubbock averaged 150 lbs. of lint cotton per acre and cultivated plats 192 lbs., and at Chillicothe 255 and 300 lbs., respectively, whereas at Beeville the respective averages were 122 and 114 lbs. The main value of cultivation appeared to be weed destruction. Cultivation enough to control weed growth was indicated as the most effective tillage. Medium to late plowing at a medium depth seemed to be the best method of preparing land for crops in the part of Texas around Lubbock.

Blue Rose and Early Prolific, rice varieties with a medium length grain, and Texas Fortuna, with a long grain, were found best for the rice section near Beaumont. The most profitable fertilizer treatment has been 100 lbs. of ammonium sulfate per acre, best applied at time of planting. Application of 1 ton of lime per acre did not affect rice yields. The viability of red rice and commercial varieties did not differ when planted under favorable conditions. Maximum germination was obtained by planting seed in moist soil. A stand could be had by planting the seed in water, but not covering with soil, and then removing the water as soon as germination began. Hulled and broken grains seemed to be worthless as to germination.

Little relation seemed to exist between the height of the strains making up series in groups of grain sorghums and the protein content of the grain, although the protein contents of the grains of the different groups differed significantly. The protein content of the feterita group averaged 12.93 per cent, kafir 11.19, milo 10.52, and the kaoliang group 10.53 per cent. Dwarf feterita was consistently higher in protein than other strains of feterita. Correlation coefficients determined in Blackhull kafir indicated that length of head, length of seed branches, diameter of plants, and weight of green forage are the characters contributing significantly toward production of grain yield. The behavior of several chlorophyll defects in kafir, one apparently a chimera, is described briefly. Heritable abnormalities observed in corn included defective seed, chlorophyll defects, golden color, striping, dwarfness, sterility, abnormal seed production, and, in the Tuxpan variety, a distinct creeping habit.

The use of the lister cultivator on milo until late in the season at Lubbock induced 10 per cent more tillering than in plats where the cultivator was used and the dirt thrown to the milo. Planting by the usual method yielded 10 per cent more than with every third row left unplanted. Grain sorghum seed treated with organic mercury compounds and copper carbonate dusts did not germinate

differently from untreated grain at Lubbock, while at Chillicothe feterita treated with copper carbonate germinated 57 per cent better and that treated with organic mercury compounds from 72 to 84 per cent better in the field than untreated seed.

The proper planting of 1 lb. of seed each at Chillicothe resulted in stands of 18 in. with milo, 11 in. with kafir, and 7 in. with Sumac sorgho, whereas 2 lbs. resulted in stands of 8, 6, and 4 in., respectively, indicating that planting more than 2 lbs. of seed per acre of any of these varieties is not necessary. It appeared that with milo every third row could be left unplanted without appreciable loss in grain yields.

Potato yields at Weslaco were in direct proportion to the amount of moisture supplied by irrigation during March under the test conditions. Overhead sprinkling was more beneficial than furrow irrigation.

The grasses of Central America, A. S. HITCHCOCK (*U. S. Natl. Mus., Contrib. U. S. Natl. Herbarium*, 24 (1930), pt. 9, pp. XVI+557-762).—An account is presented of the grasses of Central America, which embraces the area between Colombia and Mexico and lies entirely within the Tropics. Except for the summits of the high mountain peaks the flora is tropical. The flora of the lowland along the Atlantic coast resembles that of the other American tropical lowlands bordering the Atlantic Ocean. Although the climate of the elevated regions of the interior is temperate, the grasses found there are, with few exceptions, those confined to Mexico, Central America, and Colombia. This paper includes 115 genera and 460 species.

The value of supplementary bacteria for legumes, J. K. WILSON and E. W. LELAND (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 5, pp. 574-586, figs. 3).—The value of supplementing the legume bacteria which the soil naturally supports with an artificial culture for alfalfa, red clover, beans, and peas was studied at the New York Cornell Experiment Station in 1928.

Alfalfa on limed soil produced about 11 per cent more dry weight when supplementary bacteria were applied at seeding time, although roots 46 days old failed to indicate any value of the extra bacteria as measured by the number of nodules. Supplementing the legume bacteria on the unlimed soil (pH 5.3) produced more nodules, more dry weight of the crop, and more plants that survived throughout the season than on plats not receiving such treatment. Red clover on limed and unlimed soils produced 39.9 and 32.2 per cent more dry weight, respectively, when supplementary bacteria were applied at seeding time. Red kidney beans on the limed plats showed an increase of 12.8 per cent in oven-dry crop and 9.2 per cent in shelled beans per acre in favor of supplementary legume bacteria. On acid plats a slight gain of total dry crop and a slight decrease in shelled beans occurred where the artificial culture was applied. Peas grown on both limed and unlimed plats had a larger quantity of nodules on their roots than peas from plats without supplementary bacteria, and the total crop and the dried peas from these plats were also considerably larger.

The relation of ear and grain type to yield in maize, A. R. SAUNDERS (*[Union of So. Africa Dept. Agr.] Bul.* 54 (1928), pp. 17, figs. 9).—Comparisons at the Potchefstroom Experiment Station of long and short ears, smooth and rough ears, and ears with 8, 10, 12, 14, and 16 rows, taken from a commercial crop of Potchefstroom Pearl corn during the years 1925-26, 1926-27, and 1927-28, revealed no significant difference in yield of any one type over another, although the trend of yield slightly favored smooth ears and ears with kernel rows than the modal type (12 rows). One year's selection did not have any appreciable effect in changing the type; there was merely a slight shifting of the average. The slight differences in physical characteristics found

among appreciably good ears of corn appeared of no value in determining their relative productiveness.

Work on the same line in the United States is reviewed briefly.

Corn varieties recommended for North Carolina growers, G. M. GARREN (*North Carolina Sta. Agron. Inform. Circ. 44* (1930), pp. [1]+4).—Varieties of corn are indicated for the mountain, Piedmont, and Coastal Plain sections of the State from the results of varietal tests, and the technic of such tests is outlined.

Seed corn drying experiments, C. M. HARRISON and A. H. WRIGHT (*Jour. Amer. Soc. Agron., 21* (1929), No. 10, pp. 994-1000).—Ear corn when dried at the Wisconsin Experiment Station by forced warm air ventilation at from 40 to 45° C. was not injured, at 50° damaged considerably, at 60° nearly all killed, and at 70° (158° F.) completely killed. Seed corn dried to less than 10 per cent moisture at nonharmful temperatures was not injured either in germination, seedling growth, or field performance. Indeed no damage resulted when the seed corn was dried to as low a moisture content as 4 per cent. Corn dried to 12 per cent moisture or less in 72 to 96 hours at temperatures of from 40 to 45° was not injured in germination, seedling growth, or field performance, indicating that rapidity of drying was not a harmful factor.

Summary of results of cotton variety experiments conducted during 1927, '28, and '29 and production and consumption of different staple lengths, P. H. KIME and S. J. KIRBY (*North Carolina Sta. Agron. Inform. Circ. 42* (1930), pp. [1]+6, figs. 2).—The higher yielding varieties normally producing a staple of from 1 to 1½ in., e. g., Mexican and certain Cleveland strains, usually have given greater money returns per acre than the shorter staple varieties and are recommended as heretofore (E. S. R., 60, p. 735). It is pointed out that the quantity of cotton of these lengths consumed by mills located in the Southeastern States far exceeds the production in these States. The greater part of the short cotton, ¾ in. and under, is exported in competition with cotton from India and China produced under very cheap labor conditions.

Varieties of cotton being recommended by county agents and vocational teachers of North Carolina, P. H. KIME (*North Carolina Sta. Agron. Inform. Circ. 43* (1930), pp. [9], figs. 2).—The majority of county agents and vocational teachers in North Carolina were recommending improved varieties stapling from 1 to 1½ in., especially strains of Mexican and Cleveland. Many were indicating from 2 to 4 of these varieties, and some also recommended cottons producing ⅝- to ⅞-in. staple.

[Cotton research in South Carolina] (*South Carolina Sta. Rpt. 1929, pp. 32-36, 42-44, 85-87, 94-99, 107, 114, fig. 1*).—Cotton investigations (E. S. R., 60, p. 733) reviewed included variety, cultural, fertilizer, and liming and cover crop tests; fiber and physiological studies (E. S. R., 62, p. 221); and seed treatments.

Varietal trials (E. S. R., 61, p. 31) showed that several of the strains of 1-in. cotton produced by South Carolina breeders yield as much lint as and produce a greater acre money value than the ¾- and ⅝-in. cotton still planted by many growers. Strains of Cleveland, Cook, and Trice led at the Coast Substation. Cleveland strains and D. & P. L. No. 4 led the shorter cottons and strains of Foster and Express were foremost among the long staples at the Pee Dee Substation.

Cooperative fertilizer trials in the State generally gave results comparable with those of previous years, indicating that even with a systematic rotation

liberal quantities of commercial fertilizer may be applied profitably to cotton. In comparisons of side applications, cotton responded markedly to nitrogen, although phosphorus and potassium also served to increase the average yield considerably. Three hundred lbs. of sodium nitrate per acre evidently was the most profitable quantity under the test conditions. The highest yield was obtained when one-fourth of the nitrogen (50 lbs. sodium nitrate per acre) was applied at planting and the rest (150 lbs.) at chopping. Lime through its benefit to the legume crop in the rotation indirectly yet decidedly enhanced yields of cotton and corn. Fertility studies indicated that a good cover crop of vetch and rye properly handled may be as valuable for producing cotton as an application of 8 tons of fresh manure per acre.

The highest yield was obtained at the Coast Substation where one-half of the fertilizer was applied at planting and the rest at chopping. Nearly as much cotton was produced where all the phosphorus and potassium were applied at planting with all the nitrogen as a side dressing. The least cotton was obtained where all nitrogen was applied before planting and the phosphorus and potassium added as a side application. With cotton receiving no side application and making 1,713 lbs. of seed cotton at the Pee Dee Substation, the increases from various nitrogen carriers as side dressing, ranged from 164 lbs. with calcium nitrate to 533 lbs. with sodium nitrate. No great differences in yield were obtained between several methods of stirring and applying fertilizer, but smaller yields came from applying all the fertilizer as side applications. No bad effects on stand were observed in the current or previous year from applying the fertilizer close to the seed on half bed and on full bed. Potash, regardless of when applied, increased the yield. While average yields differed little, the smallest increase over no potash was produced where the potash was applied at planting.

Acid-delinted seed treated at the Pee Dee Substation with mercury dusts produced much better stands, and the resultant plants made higher yields of seed cotton. Best acre yields were obtained from plantings made April 5 to 15. Current results in the spacing tests at this substation with three varieties differing in growth habit substantiated the findings at the station and substations in tests since 1920, that for different varieties and fertility conditions closely spaced plants produced larger yields under boll weevil conditions than plants given abundant space. The partial crowding of the plants served to suppress vegetative growth and promote production of fruit early in the season. Comparisons of row width suggested that where cotton makes a rank growth, rows 3.5 to 4 ft. apart are optimum, especially where dusting machines are operated in late July and August. On land producing a small stalk closer rows may be used to advantage.

In attempts to reproduce partly the unusually cool and wet conditions in the spring of 1928 which led to the abortion of many young cotton buds, excessive moisture was supplied to cotton in the greenhouse and in the field. While conditions did not coincide with those in 1928, the flood tests showed what might be expected after repeated heavy rains. There was a vigorous growth of plants in the check plots receiving the regular application of fertilizer before planting and side applications of sodium nitrate. However, several of the weekly tests showed no trace of nitrates in the soil. Flooding the soil resulted in an abnormally high percentage of carbon dioxide in the soil air, sometimes as much as 7 per cent, whereas only from 1 to 3 per cent was found in the normal plots. The oxygen in the soil air of flooded plots usually was about 11 to 13 per cent and in the normal soil from 17 to 19 per cent. Such conditions caused considerable shedding of fruit.

Physiological studies revealed that cotton bolls early in the season ordinarily attain full size in from 18 to 20 days, although the weight rises steadily so that the final dry weight at 45 days is nearly twice that of 18 to 20 days. The dry weight of the boll walls reaches a maximum between 18 to 25 days, while the later increase in dry weight is confined to the seed and lint. In spite of the decreasing succulency of the boll, nitrogen is added continuously. No greater proportion of nitrogen is present during the very rapid growth in size in the early stages of boll development than in later stages when no size increase occurs. Determinations of nitrogen in leaves and other tissues indicated that nitrogen can be transferred from other parts of the plant to the bolls.

[Cotton investigations in Texas] (*Texas Sta. Rpt. 1928. pp. 54-56, 59-61, 66, 91, 95, 96, 97, 99, 103, 108, 109, 110, 113, 115, 117, 119, 120, 121, 126, 127, 129*).—Cotton studies at the station and substations comprised variety, cultural, and fertilizer trials; breeding work; inheritance studies; and ginning experiments.

A cluster-type plant, probably a mutation in Durango cotton, was crossed with 10 varieties in attempts to develop a cotton better suited for machine harvesting. The cluster type of fruiting was found to be recessive. A virescent yellow leaf, a chlorophyll deficiency of adult plants, seemed due to a single factor and was recessive in behavior. Green-leaved plants made on the average 20 per cent more growth in the field, yielded 50 per cent more cotton, and gave better stands of thriftier plants than did the virescent yellow plants. With another chlorophyll defect showing angular-shaped areas devoid of chlorophyll in the adult leaves, some branches of the plant had normal green leaves, while others had leaves showing various degrees of chlorophyll deficiency. This was apparently a case of cytoplasmic or maternal inheritance.

In crosses between long and short lint plants, long lint was dominant in F_1 , while in F_2 some plants arose with lint longer and shorter, respectively, than that of either parent. Crosses between two strains each having 100 per cent of 5-lock bolls produced progeny having a small percentage of 4-lock bolls, indicating that either the parent plants were heterozygous for this character or that production of 5-lock bolls may be affected by environment. Several factors appeared to be involved in the expression of seed fuzziness and petal spotting in the flowers. In crosses between Egyptian and upland cotton, the Egyptian was dominant in F_1 in regard to type of plant growth, fruiting habit, flower color, leaf shape, lint length, seed fuzziness, lint percentage, and boll size. Continued inbreeding of certain strains of cotton for several generations has not resulted in any significant decline in plant vigor.

A statistical analysis on 962 plants of Startex cotton at the station was concerned with yield, lint length, lint percentage, boll size, and several other characters. A multiple correlation was high enough, $R=0.85\pm0.01$, to indicate that 9 independent variables were closely associated with yield of lint. Significant positive partial correlations were found between yield of lint and (1) number of bolls, (2) number of fruiting branches, and (3) size of boll. Important significant positive simple correlations are listed.

The Mebane, Lone Star, Truitt, and Acala types of cotton continued to be generally well adapted to Texas conditions. The highest yields of lint cotton over periods of years came from 12 to 18 in. spacings at Spur, 18 in. at Chilli-cothe, and 12 to 15 in. at Lubbock. Certain conditions of ginning seemed to affect the length of lint and the grade of cotton.

While 400 lbs. of 12-4-4 fertilizer per acre increased the yield of cotton 11.5 per cent at Beeville, the increase was unprofitable. Sulfur as a cotton fer-

tillizer did not increase yields. No beneficial effects were gained to date at Lubbock from the application of commercial fertilizer to cotton; on the contrary, yields were slightly lower.

The current limiting factor in cotton production at Chillicothe has been soil moisture rather than soil fertility. Fertilizer applications have not influenced yield. Tillage and cultural tests, while not conclusive, gave indications that any method resulting in a good seed bed is suitable. The exact time seems not to be so important if land is prepared from 2 to 3 months before planting, since winter rainfall is light and weed growth sparse.

Cultural tests with the Jerusalem artichoke, A. ANDERSON and T. A. KIESSELBAUGH (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 10, pp. 1001-1006, fig. 1).—In production experiments at the Nebraska Experiment Station during 1925, 1926, and 1927, the Jerusalem-artichoke averaged 6.17 tons of tubers and 5.02 tons of tops per acre, or on a moisture-free basis 1.51 and 1.87 tons, respectively. The 6.17 tons of fresh tubers would produce 1.07 tons of sugar, which is 17.1 per cent of the tuber weight.

Planting tests in 1926 and 1927 suggested that there may be considerable range in planting date during the latter part of March and the first part of April without materially affecting the yield. The highest total yield per acre was obtained from spacing the seed pieces 14 in. apart in the row. Seven-in. spacing produced a slightly higher acre yield of tubers noticeably smaller in size. Very little difference in total yield came from planting small, medium, or large seed pieces, although there was an increase of about 10 per cent in the yield of tubers and a decrease of 15 per cent in the yield of tops as the number of seed pieces per pound was reduced from 50 to 10. The highest net yield of tubers was obtained from spacing the small tuber pieces 21 in. apart.

Oats in the western half of the United States, T. R. STANTON and F. A. COFFMAN (*U. S. Dept. Agr., Farmers' Bul. 1611* (1929), pp. II+22, figs. 11).—Practical information is given on the production of oats in the Great Plains, the Rocky Mountain and intermountain, and the Pacific areas under dry land, irrigated, and humid conditions. The consecutive topics deal with soils, fertility, rotations, seed bed and seed preparation, seeding, cultivation, harvesting, varieties, and oats for hay.

Certified Irish potato seed: Report of 1929 test, W. S. ANDERSON and L. E. MILES (*Mississippi Sta. Circ. 35* (1929), pp. 5, figs. 2).—Comparative trials in 1929 at the South Mississippi Substation of samples of seed potatoes from five northwestern States and Mississippi showed certified Triumph seed to average 157 bu. per acre, uncertified 128, and Mississippi-grown uncertified 89 bu. During five years certified Triumph seed averaged 142 bu. and uncertified seed 96 bu. Certified Irish Cobbler in four years averaged 163 bu. compared with 128 bu. from uncertified seed.

Potato spraying and dusting experiments, 1926 to 1928, R. BONDE, D. FOLSOM, and E. B. TOBEY (*Maine Sta. Bul. 352* (1929), pp. 97-140, figs. 2).—The effects of spraying and dusting potatoes, studied further (E. S. R., 56, p. 338) in 1926, 1927, and 1928 in Aroostook County, are reported on, with review of tests in other regions and observations on commercial spraying and dusting and on costs of and profits from the use of fungicides.

A yield increase resulting in 1926 from homemade Bordeaux mixture in two experimental fields was not consistent enough to be significant, and its extent was determined largely by the control of late blight and by the time of the killing frost. The yield increase from Bordeaux spraying in 1927 was highly significant, again being due to the control of late blight, which was severe. Some increase also was obtained from colloidal copper. Copper lime dust and

sodium fluosilicate dust controlled late blight. With late blight very severe, similar good control and large yield increases were had in 1928 with homemade Bordeaux mixture, half copper strength colloidal copper spray, copper lime dust, commercial dried and powdered Bordeaux used as a spray, and the last used as a dust. In all three years very little rot developed in storage, even in stock from untreated plats, and other diseases besides late blight and insects were not important.

The gain in yield from spraying has varied greatly with the season, averaging during 13 years about 8 per cent of the average check yield of 323 bu. Slightly more gain was obtained in five years' comparison in Aroostook County from using copper lime dust than from Bordeaux spraying, although both averaged about 5 per cent over the check yield of 332 bu. Review of reports from other regions showed that many conditions influence results, and that plat technic often is inadequate, but that apparently a tendency exists for copper lime dust to be less effective than Bordeaux mixture against flea beetles, leafhoppers, and tipburn.

A vine protector device reduced injury from sprayer wheels, resulting in a significant increase in yield of 19 bu. an acre, or about 5 per cent. Vigor of seed stock was not increased by spraying the parent plants. It appeared that a delay in beginning the season's dusting or spraying could increase yield. However, omission of certain applications might be attended by risk. Leaf samples from the 1924, 1925, and 1928 tests showed two or three times as much copper accumulating with standard Bordeaux as with other materials, even with like effectiveness and yield increases.

Mild mosaic increased susceptibility to late blight foliage injury in Green Mountains. Tuber rotting by late blight was not necessarily proportional to foliage injury by the same disease but seemed to vary with soil type and other conditions, and under some conditions may be increased by spraying.

Studies in Indian oil seeds.—No. 3, *Carthamus tinctorius* Linn.: The types of safflower, A. R. KHAN (*India Dept. Agr. Mem., Bot. Ser., 18 (1929), No. 3, pp. 81-87, pls. 2*).—The third paper of this series (*E. S. R., 51, p. 532*) describes 10 additional types of safflower isolated from seed obtained from Dacca and Behea near Patna. The 10 new types and the 24 described earlier (*E. S. R., 36, p. 228*) are grouped in a determinative key, and the oil contents and seed weights are tabulated for each.

Methods of improving grain sorghum varieties, H. H. FINNELL ([*Oklahoma*] *Panhandle Sta., Panhandle Bul. 12 (1930), pp. 3-8*).—Consideration of methods of improving varieties of grain sorghum led to the conclusion that mass selection or the breeding of pure lines selected within a variety affords little promise of marked improvement in productivity, although very important to the seed grower and farmer for maintaining the purity of established varieties. The greatest opportunities for marked improvement seem to lie in hybridization of well-matched varieties. Technic is outlined.

Sorghum-Sudan grass hybrids, A. W. S. MOODIE and A. A. RAMSAY (*Agr. Gaz. N. S. Wales, 40 (1929), No. 10, pp. 731-735, figs. 3*).—Moodie found that F_1 plants of Sudan grass \times Saccaline sorgho at from 9 to 12 in. high could be distinguished readily from Sudan by the thick stem, broad leaves, and profuse stooling, and measurements showed them to be intermediate in every way. Examination by Ramsay of plants from 12 to 18 in. high showed the hybrids to contain different quantities of hydrocyanic acid ranging from 0 to 0.01 per cent. It appeared possible that the crossing of sorghum with Sudan grass might give rise to progeny containing much more hydrocyanic acid

(three times as much) than the sorghum parent. In these trials two-thirds of the samples contained as much as or more hydrocyanic acid than the male parent (sorgo), while one-third contained less. The analytical data also indicated the potential danger of the presence of such hybrids in connection with the feeding of stock.

Sowing sweet clover in wheat, C. J. WILLARD and L. E. THATCHER (*Ohio Sta. Bmo. Bul. 142* (1930), pp. 19, 20).—Sweetclover seed in the hull sown at wheat seeding time and in December at the station and in January and February at Columbus produced satisfactory stands from all the dates of seeding. While it is not yet certain that the early sowing of seed in the hull or even unscarified seed on wheat would be superior to scarified seed sown in wheat somewhat later, there was a decided indication in that direction. Stands were injured by the tendency of scarified seeds to germinate quickly in periods of mild weather, with subsequent killing of sprouts when freezing weather followed.

Some effects of seed treatment on the germination and subsequent growth of wheat, D. C. SMITH and E. N. BRESSMAN (*Jour. Agr. Research [U. S.], 40* (1930), No. 1, pp. 25-36, figs. 3).—None of several treatments applied to germinating wheat seed at the Oregon Experiment Station proved highly stimulative to growth or a modifier of growth habits of winter, semiwinter, and spring wheats. Among a number of chemicals applied in solutions, ammonium thiocyanate was decidedly toxic as a seed treatment, reducing stands and also vigor, even though heads were produced. It reduced germination and sprout growth and also the length of roots in Kanred and White Winter wheat. Ethyl bromide was slightly toxic to root and sprout growth of the latter variety and reduced its germination markedly as compared with effects on other wheats. Checks soaked in water were from 1 to 3 days earlier in time of heading than those not so treated. Incubation of chemically treated seeds in the germinator for 20 hours before sowing increased the number of heads of spring-planted winter wheats.

Germinating wheat grains survived 12 days of constant freezing at -12° C. Alternate freezing and thawing was more harmful to seedling growth than was continuous freezing. Marquis wheat survived the low temperatures in the tests much better than did Kanred. Germination after exposure to low temperature was not indicative of the comparative winter hardiness of these two wheats. Considering subsequent growth, winter wheats showed an individual reaction to time of planting, e. g., Kharkof matured when sown later than the last date of planting for normal heading of Hybrid 128. For late seasons the critical date of planting for heading was correspondingly later.

Wheat production in Kansas, S. C. SALMON and R. I. THROCKMORTON (*Kansas Sta. Bul. 248* (1929), pp. 84, figs. 45).—This practical discussion of wheat growing in Kansas makes information available on the status and environmental needs of the crop, its relation to diversified farming, soil treatments and preparation, the characteristics of and choice of varieties, seed and its treatment, cultural methods and field practices, harvesting and marketing the crop, production of high-protein wheat, and insects, diseases, and weed pests. The experimental findings supporting the recommendations have been noted extensively from previous reports (E. S. R., 61, pp. 125, 132) and other sources.

Additional suggestions on spraying weeds with chlorates, C. J. WILLARD (*Ohio Sta. Bmo. Bul. 142* (1930), pp. 8-11, figs. 2).—Further experiments in weed control with chlorates (E. S. R., 61, p. 640) were made in 1929 at Ohio State University and several test farms. Tentative observations may be summarized as follows:

Serious accidents in Ohio and elsewhere from sodium chlorate emphasized the worth of the indicated precautions. The method is recommended for small areas only. Sprays applied in April or early May before much growth had taken place were much more effective than at any other later date up to September 1. Even for Canada thistles early spring sprays proved very much more effective per pound of chlorate. Spraying when the soil was wet definitely favored killing. Nearly as much spray seemed to be taken to kill sprouts that recovered after spraying as to kill unsprayed plants, suggesting that an initial application that does not kill most of the plants is largely wasted. "We would not now recommend an initial application of less than 2 lbs. per square rod for either quack grass or Canada thistles." A certain amount of injury to succeeding corn, oats, wheat, and clover was observed. Spraying in July with 1 gal. to the square rod of the solution containing 0.5 lb. of sodium chlorate per gallon killed oxeye daisies, but not the grass in which they were growing. White snakeroot was killed by one application of spray containing 1 lb. per gallon. Usually perennial weeds with shallow root systems were more readily killed than those with deeper root systems. Calcium chlorate appeared at least as effective as sodium chlorate in proportion to its chlorate content, but not equal pound for pound.

Chemical control of ragwort, R. E. R. GRIMMETT and C. R. TAYLOR (*New Zeal. Jour. Agr.*, 39 (1929), No. 6, pp. 382-384).—More elaborate attempts to control ragwort (E. S. R., 62, p. 431) indicated that the best and most economic time for application of the mixture, preferably three parts salt and one part iron sulfate at 0.5 to 1 oz. per plant, was when the ragwort was about 3 in. high. Plants near maturity may require 2 or 3 oz. Bruising the crown with the heel assisted materially. Chemical control on moderate infestations (3,000 plants per acre) had advantages over hoeing, but was uneconomic for heavy infestations, the labor cost being prohibitive.

False wild oats, A. R. CALLAGHAN (*Agr. Gaz. N. S. Wales*, 40 (1929), No. 9, pp. 625-631, figs. 4).—Aberrant types appearing in Mulga, Guyra, Walla, Algerian, and Budgery oats are described and illustrated, with remarks on the possible control of false wild oats.

HORTICULTURE

Experiments with fruits and vegetables [at the South Carolina Station] (*South Carolina Sta. Rpt. 1929*, pp. 73-76, 78-82, 101, 102, figs. 4).—Of eight varieties of apples. Delicious, Winesap, Stayman Winesap, Yates, Ben Davis, Rome, Golden Delicious, and Early Harvest, tested for fruitfulness, none was fully self-fruitful. Delicious, Stayman Winesap, Winesap, Yates, and Golden Delicious failed to set fruit when self-pollinated. Delicious and Golden Delicious pollen proved effective for other varieties, but Stayman Winesap pollen was of no value, even failing to germinate in a 12 per cent cane-sugar medium. Winesap and Yates pollen germinated satisfactorily but gave poor results in pollination. Delicious pollen held for 4 days under ordinary room conditions apparently lost strength. Ben Davis and Early Harvest proved interfruitful and were satisfactory pollinizers for Winesap, Stayman Winesap, Yates, Delicious, and Golden Delicious. Rome bloomed too late to serve as a pollinizer except for Winesap. The number of seeds per apple is deemed a good index of the pollinizing value of the male parent. For example, Early Harvest set 3.5, 8.6, 9.4, and 9.8 seeds per fruit with self, Delicious, Ben Davis, and open pollination, respectively.

In variety tests the Van Fleet raspberry is reported to have yielded good crops of medium size, fair quality berries but with a tendency to shatter when

overmature. Under dry conditions the Klondyke, Missionary, Big Late, and Big Wonder strawberries proved best among 40 varieties tested.

At Clemson College and Monetta asparagus responded favorably to heavy fertilization with a 7-5-3 mixture. An application of 1,200 lbs. of 8-4-4 fertilizer to bush Lima beans gave larger yields than did heavier or more concentrated applications. Some indication was obtained that the inoculation of seed was helpful.

Studies in peach propagation suggested that the size of seed influenced the growth of the seedlings. Seeds weighing 0.75 to 1.25 gm., 6 to 7 gm., and ungraded produced seedlings with average height just before June budding of 21.3, 30, and 23.7 in., respectively.

Measurements of the growth of young tomato plants in various types of containers showed all paper, peat, fiber, and wood containers to give poor results, a condition ascribed to the competitive use of soil nitrates by the cellulose-decomposing bacteria. Supplemental applications of readily available nitrogen restored normal growth.

Data were taken on 76 varieties of carrots and 9 varieties of early cabbage with a view to establishing accurate varietal standards. The Chantenay carrot proved to be the most desirable for local conditions.

Tests of two mulch papers gave indications of earlier and larger yields with paper and also that germination may be accelerated and increased.

At the Pee Dee Substation the Delaware proved to be the most hardy northern-type grape, with Concord a close second. Brighton was fairly hardy and Lutie and Niagara less so.

Trials with iris, tulip, and gladiolus gave poor results with the first two species but showed the last to be highly promising.

[*Horticultural investigations at the Texas Station*] (*Texas Sta. Rpt. 1923, pp. 19-27, 96, 97, 101, 114, 118, 124-126, 127, 130, 131*).—The usual annual report (*E. S. R., 59, p. 740*).

As a result of adaptability tests two plants, the Bruce plum and the tung-oil tree, are recommended for trial. More than 45 blackberries and over 12 dewberries and loganberries were assembled at the Troup and Nacogdoches Substations in a search for better varieties. Vinifera grapes were more drought resistant but less frost resistant than American types.

At Angleton lime apparently increased the yield of figs, but sulfur gave no beneficial results. Heavy pruning delayed the ripening of figs and lengthened the period of ripening. Bordeaux 5-5-50 was the most satisfactory control for fig rust. No variety superior to Magnolia was discovered.

At the Beeville Substation all citrus except Satsumas were severely injured by a temperature of 16° F. but for the most part made a strong recovery.

The Fargo and Viking tomatoes as tested at Troup were failures but gave encouraging results at Weslaco. At Troup the Gulf States Market tomato surpassed the Marglobe in yield and percentage of marketable fruits. Little difference was noted between an application of 300 lbs. of superphosphate, 150 lbs. of nitrate of soda, and 70 lbs. of muriate of potash and the same formula with 90 lbs. of muriate of potash. Up to 70 lbs. per acre increases in potassium did increase yields.

At the Angleton Substation fig trees sprayed for rust survived the minimum of 16°, while unsprayed trees were killed apparently by delayed dormancy. Superphosphate alone or combined with nitrate of soda or nitrate of potash gave the largest yields. Lime alone increased yields but when combined with complete fertilizer had little effect. Moderate pruning of figs gave better results than hard pruning.

Some indications were obtained at the Balmorhea Substation that hardy varieties of vinifera grapes might be grown commercially. In selecting plants resistant to cotton root rot flowering pomegranate, live oak, pecan, honeysuckle, and tamarix showed promise.

At the Nacogdoches Substation a peach, S. P. I. No. 43,290, withstood 12° in January, setting a heavy crop of fruit.

At the Weslaco Substation irrigation was found more important than fertilizers and probably as important as cover cropping in developing grapefruit trees. Cultivation was not found essential. Quickly available nitrogen fertilizers gave the best results. Evidence was secured that trees differ in inherent yield capacities. Alfalfa sod produced good yields as compared with clean tillage plus fertilizers. Heavy pruning reduced yields but had little effect on size. The yield differences between the unpruned and lightly pruned trees were negligible. Calamondin stock proved very satisfactory for kumquats, Satsuma oranges, and the Meyer lemon and certain round oranges, while grapefruit and strong-growing oranges tended to overgrow the stock. Calamondin apparently imparted hardness to the lime, since low temperatures which killed King Mandarin trees on sour orange did not injure limes on Calamondin.

The results of variety and strain tests with cabbage, onions, beets, carrots, and tomatoes are reported. Although larger yields were obtained in 3 by 3 ft. spacing of tomatoes than in greater distances, the fruits were smaller. The time of ripening was not affected by spacing. Wind protection was apparently afforded by close planting. Observations on individual tomato plants showed differences in uniformity and in the percentage of puffy fruits. Irrigation apparently reduced the percentage of puffy tomatoes, and fertilizer in excessive quantities apparently increased this condition. In equal quantities an 8-4-0 (P-N-K) fertilizer gave better yields than did an 8-4-4 or an 8-4-8. Spraying increased tomato yields. The results of plant introduction and adaptability tests with various plants are cited.

At Iowa Park peach buds were killed by a spring freeze, even where the trees were flooded. Compass and Sapa plums fruited, and jujubes bore heavily. Grapes and apples were injured by root rot disease. Notes are given on truck and vegetable tests.

[Horticultural investigations at the Canadian experimental stations and farms] (*Canada Expt. Farms, Rpts. Supts. 1928, Agassiz (B. C.) Farm, pp. 18-21, 22-24, 25-27; Brandon (Man.) Farm, pp. 37-39, 40-42, figs. 2; Charlottetown (P. E. I.) Sta., pp. 19-33, figs. 3; Farnham (Que.) Sta., pp. 18, 19; Fredericton (N. B.) Sta., pp. 19-26, fig. 1; Indian Head (Sask.) Farm, pp. 30-40, 42-46, figs. 2; Kapuskasing (Ont.) Sta., pp. 27-29, 30, 31, 32-34; Lacombe (Alta.) Sta., pp. 64-67, 69-71; La Ferme (Que.) Sta., pp. 20-28, 31-36; Lennoxville (Que.) Sta., pp. 41-51, fig. 1; Leithbridge (Alta.) Sta., pp. 47-51, 52-55; Nappan (N. S.) Farm, pp. 35-37, 38-41, fig. 1; Rosthern (Sask.) Sta., pp. 19-23, 24-27, figs. 2; Ste. Anne de la Pocatière (Que.) Sta., pp. 24-36, 37, 38, fig. 1; Scott (Sask.) Sta., pp. 32-35, 36-39, figs. 2; Swift Current (Sask.) Sta., pp. 32-35, 36-38).*

Brief reports are again presented (E. S. B., 60, p. 539) by W. H. Hicks, M. J. Tinline, J. A. Clark, R. Bordeleau, C. F. Bailey, W. H. Gibson, S. Ballantyne, F. H. Reed, P. Fortier, J. A. McClary, W. H. Fairfield, W. W. Baird, W. A. Munro, J. A. Ste. Marie, G. D. Matthews, and J. G. Taggart, respectively, on the results of miscellaneous varietal and cultural studies with fruits, vegetables, and flowers.

[Horticultural investigations at the Sidney, B. C., Experimental Station, 1928], E. M. STRAIGHT (*Canada Expt. Farms, Sidney (B. C.) Sta. Rpt. Supt. 1928, pp. 11-20, figs. 2*).—Continuing investigations with fruits and vegetables

(E. S. R., 60, p. 539), a study was made of seedling loganberries which revealed a wide variation in shape, size, degree of acidity, etc. Of five treatments, nitrate of soda, muriate of potash, superphosphate, mixed fertilizer, and none, the nitrate alone was practically as effective as the mixed material in increasing the yield of pears and was decidedly in the lead in the case of the apple.

[Horticultural experiments at the Summerland, B. C., Experimental Station, 1928], W. T. HUNTER (*Canada Expt. Farms, Summerland (B. C.) Sta. Rpt. Supt. 1928, pp. 4-24, 25-29, figs. 3*).—The usual annual report (E. S. R., 60, p. 540).

In his work on tree fruits, R. C. Palmer reports that apricots of four varieties picked at various stages of maturity from the same tree on the same day and graded according to color were boxed and shipped to 19 distant points for determining the relation between picking condition and shipping quality. When picked in the turning stage the fruit carried well but developed only fair quality, leading to the conclusion that precooling and refrigeration are necessary to get good quality apricots to the consumer. Pressure readings showed considerable variation between the varieties at the same color stage.

Cherry pollination studies conducted in 1928 indicated that Black Tartarian and Deacon are good pollinizers for Lambert, Bing, and Nan C. Bing.

Of three types of pruning (long, intermediate, and short), tested on the apricot, but little difference was noted between the first two in respect to yield, with a decidedly depressing effect of short pruning. A comparable situation was observed in the peach.

Reporting on vegetable gardening, W. M. Fleming in work upon the relation of soil temperature to time of sowing muskmelon seed states that daily records taken of soil temperatures at various depths indicated the advisability of taking records at 2 ft. or more in order to avoid daily fluctuations. An index to safe time to plant was found in the soil temperature at a 24-in. depth, 50° F. for 3 days being a criterion of safety. No outstanding differences were noted between six methods of handling muskmelon plants, those seeded directly in the open giving approximately equal yields to transplants.

The need of heavy watering of celery was indicated, and evidence was obtained that peppers cross naturally in the field.

A purple-flowered rogue of the Kenneth sweet pea gave rise to purples and pinks in the ratio of 3 to 1 in the F_1 , with two whites carrying a faint lavender tint. In the F_2 the pinks bred true, some of the purples bred true, the others splitting into purples, pinks, and tinted whites, and the two lavender tinted whites segregated into lavenders and tinted whites, a type of segregation considered by the author to be indicative of an original cross.

Growing tree and small fruits, H. B. KNAPP and E. C. AUCHTER (*New York: John Wiley & Sons; London: Chapman & Hall, 1929, pp. XIII+510, figs. 224*).—An adaptation of the previously noted text (E. S. R., 62, p. 228) by the same authors, designed to meet the needs of schools and departments of vocational agriculture.

Apple trees properly fertilized thrive in sod, L. W. SHERMAN (*Ohio Sta. Bimo. Bul. 142 (1930), pp. 20, 21*).—Records taken in a young orchard established at the Mahoning County Experiment Farm in 1921 and maintained partly in sod and partly in tillage showed that sod culture supplemented with nitrate of soda and with grass cut among the trees is a satisfactory method of management. The sod trees grew faster and fruited earlier than those grown under cultivation with nitrogen fertilizer.

Studies in the root and shoot growth of the strawberry.—V, The origin, development, and function of the roots of the cultivated strawberry

(*Fragaria virginiana* × *chiloensis*), C. E. T. MANN (*Ann. Bot. [London]*, 44 (1930), No. 173, pp. 55-86, pls. 3, figs. 14).—As a further contribution to the general subject (*E. S. R.*, 58, p. 39), there are presented the results of anatomical and microchemical studies upon root and shoot development in the strawberry.

Adventitious roots were found to arise from small groups of meristematic tissue within the stele, in greatest number in the region of departure of leaf-trace bundles. Differentiation of the apical meristem of the root generally occurred before the differentiation of the secondary vascular cambium of the stem. The initiation of root meristems in the stem occurred during vigorous growth, with further development associated with a period of carbohydrate accumulation and marked increase in dry matter.

Tracing the anatomical structure through the greater part of three seasons, there was observed as a characteristic feature in the older main roots the development of a specialized polyderm, the structure of which is described in detail. Lateral roots differed essentially from main roots in their characteristic spring development, in the general absence of polyderm, and in the earlier cessation of functional activity. Starch accumulation attained two maxima, one in late autumn and one in June and early July. In primary roots starch accumulated in the cortex, while in roots showing secondary growth starch was found chiefly in the phelloid cells of the polyderm.

The distribution of *Primulas* from the Himalaya to China, with descriptions of some new species, F. K. WARD (*Ann. Bot. [London]*, 44 (1930), No. 173, pp. 111-125, fig. 1).—A general discussion.

Roses and their culture, S. C. HUBBARD (*New York: Orange Judd Pub. Co.; London: Kegan Paul, Trench, Trübner & Co., 1928, rev. ed., pp. 127, pls. 13, figs. 3*).—General information is presented on how to propagate, grow, and exhibit outdoor roses in America.

Care of house plants, W. W. WIGGIN (*Ohio Sta. Bimo. Bul.* 142 (1930), p. 29).—Brief suggestions are presented on the care of house plants.

FORESTRY

Forest nursery and planting practice in the California pine region, S. B. SNOW (*U. S. Dept. Agr. Circ.* 92 (1930), pp. 75, figs. 17).—Pointing out the vast area of once forested land in California now needing replanting and the difficulties of restocking due to brush, drought, and various factors, this circular summarizes past experiences and discusses practices essential to success as ascertained in miscellaneous experiments. Direct seeding met with almost universal failure, and planting was beset by various obstacles, such as rodents, drought, and lack of essential knowledge.

The ratio between weight of top and weight of roots was found highly important. In general in plants having equal or approximately equal ratios those with the greatest weight showed the highest survival in the field, and of groups having roots of equal or approximately equal weight those with the lowest ratio of tops to roots showed the greatest survival. In western yellow and Jeffrey pines it was found that about 54 per cent of the seed could be expected to produce vigorous seedlings, while in sugar pine and incense cedar the percentages were about 25 and 20, respectively.

In respect to season of sowing seed, fall gave earlier and more rapid germination in all species than did spring sowing. Western yellow and Jeffrey pines, rapidly germinating species, produced the better plants from spring-grown seed. The slower germinating species, sugar pine, white pine, and incense cedar

benefited decidedly from fall sowing, but the seedlings needed protection from spring frost. Spring sowing is conceded to be the only practicable method of handling Douglas fir.

In respect to density of sowing, it was found that medium sowing gave the best results, very dense stands resulted in spindling plants, while thin stands tended to overdevelop the tops. Species with heavy seeds, notably the sugar, Jeffrey, and western yellow pines, required deeper planting of seed than did the light-seeded species, such as Douglas fir. No significant difference was observed between drilling and broadcasting seed.

Comparing pine needles and burlap as seed bed mulches, the latter proved better, except for sugar pine. Concerning shade, hardy species grew as well without as with shade; in fact, the pines did better in the open. Sensitive species, such as sugar pine and Douglas fir, required shade. Cultivation did not prove a substitute for watering but was beneficial in itself. Abundant water proved indispensable.

In field plantings it was found that slow-growing species benefited by two years in the seed bed, but that others with taproots needed to be moved annually. Although brush proved beneficial as a shade plant for many species, it competed seriously for moisture. Shade requirements differed with species, being unnecessary for hardy species in normal precipitation years. Very exacting species, such as the big tree, showed no survival without shade. Survival was higher on recent burns than in unburned brush fields. Attempts to introduce species on soils on which the species did not grow naturally met with failure. In the case of species planted on exposed heavy clay soil the survival for spring plantings was from 3 to 7 per cent greater than in fall plantings. On brushy sites rodents caused greater damage to the fall-set trees. In general, very early spring planting was most successful.

Sterilization of coniferous seed-beds with low-pressure steam, T. C. SCHAEFER (*Jour. Forestry*, 28 (1930), No. 1, pp. 42-49, figs. 2).—At the University of Washington it was found that low-pressure steaming was an entirely satisfactory means of sterilizing soil if temperatures of 95-100° C. were maintained for 60 minutes at the surface of the soil. In the case of Douglas fir, western yellow pine, and Sitka spruce, the increased number of seedlings resulting from sterilization, as determined from counts made at the end of the season, amounted to 18, 240 to 376, and 38 to 62 per cent, respectively. Repeating the process after a 24-hour interval gave even better results in the case of western yellow pine. Steaming resulted in stronger root and crown development. A delay of two or three days following sterilization before planting apparently removed any hazard from toxic substances. At 100° the mycelium and spores of damping-off fungi were killed in a period not exceeding 5 minutes. Weed seeds were destroyed in from 5 to 8 minutes, resulting in a marked reduction in weeding costs.

Hastening the germination of some coniferous seeds, L. V. BARTON (*Amer. Jour. Bot.*, 16 (1929), No. 10, pp. 856, 857).—Stratification of various coniferous seeds at low temperature in moist acid peat gave favorable results at the Boyce Thompson Institute for Plant Research. The specific requirements of the several species are presented in some detail.

Germination of *Ilex* seeds, J. GIERSBACH and W. CROCKER (*Amer. Jour. Bot.*, 16 (1929), No. 10, pp. 854, 855).—Monthly plantings at the Boyce Thompson Institute for Plant Research of holly seed of three species, namely, *I. opaca*, *I. aquifolium*, and *I. verticillata*, showed that spring is the best time for sowing the seed of the first two species and that all species required a long pregermination period. Seeds from mature berries gave higher germination than those from green berries.

Length of exposure to low temperature as a factor in the hardening process in tree seedlings, R. B. HARVEY (*Jour. Forestry*, 28 (1930), No. 1, pp. 50-53, fig. 1).—Comparing the effects of 5 days at 0, 10, and 20° C. on the development of hardiness in elm seedlings, as measured by the results of 24 hours' exposure at -5°, it was found at the Minnesota Experiment Station that 0° was decidedly most effective in promoting hardiness. In the 0° lot top branches were killed on only 10 per cent of the seedlings, at 10° all of the seedlings lost their tops but buds at soil level survived, while at 20° 96 per cent were killed. Alternation from 0 to 20° resulted in less injury upon subsequent freezing than did continuous exposure at 10°. However, very frequent alternations (0.25, 0.5, and 1 hour) did not induce as great hardiness as did exposures for 2-, 4-, and 8-hour intervals, presumably because the shorter exposures failed to lower the temperature in the seedlings on account of temperature lag.

Age of black walnut sapwood, T. S. CORLE (*Jour. Forestry*, 28 (1930), No. 1, p. 97).—Incidental to volume studies of black walnut conducted in 1929 in Illinois by the Central States Forest Experiment Station, it was found that the average age of sapwood on the stump was 16.25 years, with a range of from 12 to 19 years. At average heights of 9.9, 17.25, and 24.4 ft. the sapwood averaged about 12 years in all cases. The age of all sapwood limbs was 12 years in 29 trees, 11 years in 2, and 13 years in 1.

Properties of western hemlock and their relation to uses of the wood, R. P. A. JOHNSON and W. H. GIBBONS (*U. S. Dept. Agr., Tech. Bul. 139* (1929), pp. 62, pls. 11, figs. 21).—Discussing in a general way the character and range of western hemlock forests, the cut and supply, and the value of the timber, the authors present detailed information on the properties and uses of western hemlock lumber, taking into consideration the distinguishing characteristics of the wood, natural defects, grades and their characteristics, mechanical, physical, and chemical properties, and the relation of these properties to uses, both as general building material and for various industrial purposes.

[**Forestry at the Texas Station**] (*Texas Sta. Rpt. 1928*, p. 77).—Live oak, Chinese pistache, and *Quercus serrata* grown from seed obtained in China all showed marked hardiness. Hybrid oaks of live oak descent were found superior to their parent species in hardiness, rate of growth, and beauty. Of five cypresses tested the Italian is considered the most valuable. The Deodar cedar gave excellent results at Troup but failed at College Station. The Maritime pine flourished at College Station despite shoot borer injuries.

[**Forestry [at the South Carolina Station]**] (*South Carolina Sta. Rpt. 1929*, p. 90).—The maintenance of 50-ft. fire lines around the forest lands of the Coast Substation resulted in a record of no fires in the protected zone in 3 years, despite annual burns in contiguous tracts. The protected trees made satisfactory growth.

DISEASES OF PLANTS

Botanical and bacteriological research [at the South Carolina Station] (*South Carolina Sta. Rpt. 1929*, pp. 40-42).—Tests under controlled greenhouse conditions of a large number of cotton varieties for resistance to cold in the seedling stage revealed several capable of withstanding low temperature, thus suggesting the possibility of developing strains able to withstand cold, wet weather. Heavy rains in August and September, 1923, caused serious boll rotting and consequent injury to the seed. Injured seed often germinated fairly well in the tester, even though lacking in sufficient vigor to develop in the field. Two fungi, *Diplodia* and *Fusarium*, were the chief causal factors in the rotting of bolls.

Root rots, bacterial blights, and anthracnose took a heavy toll of the bean crop. The importance of crop rotation and clean seed is stressed, and a plan of growing beans in late summer to obtain clean seed is discussed.

A plant disease survey showed considerable late blight of potatoes, bean diseases in epidemic proportions, pecan diseases, especially scab, to be increasing, an outbreak of *Ascochyta* rot on cotton, and the *Diplodia* and *Fusarium* rots on cotton bolls.

[Phytopathological investigations at the Texas Station] (*Texas Sta. Rpt. 1928, pp. 68-70, 103-106, 121, 127-129, 131, 132*).—Cotton root rot studies showed that infected live roots play an important rôle in the spread of the disease. Where the soil was sifted to remove such roots, the disease did not appear the subsequent year. Attempts to isolate the organism from the soil or from dead roots were unsuccessful, and successful growth was not obtained from spores germinated under artificial conditions. Field observations showed an absence of infection on certain bottom soils, while abundant infection occurred on adjacent slopes. However, the inoculation of bottom plants produced infection which overwintered and caused subsequent damage. In tests of seven soils, it was found that cotton grown in soils neutral or alkaline succumbed to root rot, whereas in acid soils plants remained healthy, notwithstanding repeated inoculation. Sodium chloride in different amounts did not prove of any value, and other materials yielded inconclusive results. No variety or strain of cotton was found to be immune.

At the Temple Substation cotton root rot studies were conducted as above outlined. Of legumes tested on root rot infected soils, guar was the only species successfully grown. A systematic study of native weeds showed root attacks on a large number of native plants, and it is thought that these serve as carriers of the disease. Root rot was found to a depth of 57 in. on certain species of roots. Studies in various root rot areas showed, in most cases, sufficient weeds present to carry over the disease.

At the Chillicothe Substation a suspected new sorghum disease very destructive to milo was found capable of reproducing the disease by inoculations from pure cultures. The new disease organism is believed to be a weak parasite associated with chinch bug attack.

At the Weslaco Substation sulfur and sulfur compounds were more effective than copper compounds in controlling mildew on cucumbers. Sulfur caused less injury to cucumbers than to cantaloupes. Seed treatment gave good results in the case of scabby potato seed, and soaking the seed pieces in superphosphate solution apparently increased the yield of marketable tubers. The scraping of grapefruit trees affected with gummosis and scaly bark proved beneficial, more so than subsequent painting with antiseptics. Heavy pruning and defruiting were beneficial in the case of badly infected trees. A mixture of resin, alcohol, and bichloride of mercury proved an effective wound covering.

At the Beaumont Substation Bordeaux mixture 5-5-50 gave the best control of fig rust.

Cotton root rot control studies at the Weslaco Substation showed the possibility of artificial infection of woody plants, such as the olive, peach, prune, pear, apple, grape, etc. Freshly infected cotton roots provided a potent source of infection, but macerated roots caused no infection. No infection was produced in fibrous-rooted plants, such as corn and sorghum. The cotton plant was apparently killed by the girdling of the taproot. Sulfur, manure, superphosphate, and muriate of potash were of no benefit in controlling root rot. Winter spread amounted to 3 to 10 ft. during a 7 months' period. Of grapes, Mustang, Black Spanish, Champanel, 3306 Hybrid, and *V. champini* exhibited resistance to root rot.

At the Iowa Park Substation various methods were tried for controlling root rot, with inconclusive results. Fall inoculations showed the possibility of securing infections at that season. Susceptibility tests were made on 105 varieties of nursery stock and 52 varieties of alfalfa.

On the occurrence of pycnia and aecia in certain rust fungi, J. H. CRAIGIE (*Phytopathology*, 18 (1928), No. 12, pp. 1005-1015, figs. 3).—Claiming that *Puccinia helianthi* and *P. graminis* are heterothallic, that the majority of pustules from infections by single sporidia of these rusts never produce aecia, and that when pycnosporangia-containing nectar of such pustules is transferred from one to another with thorough mixing, aecia soon appear, the author adds observations and experiments bearing on the problem of sex in rust fungi. Pustules of monosporidial origin are designated as simple, and those of bisporidial origin as compound.

Experiments in the greenhouse showed that *P. graminis* is heterothallic. Aecia developed spontaneously in few or no simple pustules of *P. helianthi*. Simple pustules of *P. coronata*, *P. pringsheimiana*, *Gymnosporangium* sp., and *P. graminis* occur under natural conditions on their respective aecial hosts.

Pustules of *P. coronata*, *P. pringsheimiana*, and *P. graminis* have been found in nature bearing aecia in only one sector, or part, of each pustule. Experimentation in the greenhouse with simple pustules of *P. graminis* and *P. helianthi* reproduced similar conditions, which further indicates that *P. coronata* and *P. pringsheimiana* are heterothallic.

The control of teliospore and urediniospore formation by experimental methods, C. W. WATERS (*Phytopathology*, 18 (1928), No. 2, pp. 157-213, figs. 3).—It has been the aim of this work to determine a fundamental principle underlying and governing the appearance or nonappearance of the teliospore generation in the rusts, also to analyze the experimental results obtained and their relation to such a principle.

It appears from the experimental results described that all the rusts studied are dependent directly upon the photosynthetic activity of the host. Any factor or group, as light, temperature, moisture, or, as in climate, a complex, may and does so influence the host metabolism that the fungus changes from the uredinial to the telial generation, or in the reverse direction. Results are detailed as obtained in Petri dishes or in the greenhouse.

Physiologic specialization in some cereal smuts, H. A. RODENHISER (*Phytopathology*, 18 (1928), No. 12, pp. 955-1003, figs. 18).—It is stated that *Ustilago tritici*, *U. nuda*, *U. hordei*, *U. levis*, *U. avenae*, *Tilletia levis*, and *T. tritici* are widespread group species.

Fourteen forms of *U. tritici*, 12 of *U. nuda*, 7 of *U. hordei*, 5 of *U. levis*, and 18 of *U. avenae*, studied in detail, are distinguishable by color, topography, surface consistency, and type of margin, when grown on the proper media. Differences among forms of *U. nuda* may be far greater than those between *U. tritici* and *U. nuda*, and the same is true in the case of *U. levis* and *U. avenae*. Forms of *U. tritici*, *U. nuda*, and *U. hordei* differ also in their physicochemical reactions.

Oat varieties varied greatly in their resistance to smut. Markton, Black Mesdag, Golden Giant, and *Avena brevis* were immune. *A. strigosa* and varieties of *A. sterilis* were resistant. Most of the varieties of *A. sativa* and *A. sativa orientalis* were susceptible. Two physiologic forms of *U. hordei* are recognizable by their parasitic behavior on Lion and Himalaya barley. *T. levis* and *T. tritici* comprise physiologic forms differing in virulence on Kota, Marquis, and Pentad wheats and on Einkorn. Of collections of *T. levis* obtained from Minnesota, Italy, Egypt, and Hungary, there were at least three physio-

logic forms. Of collections of *T. tritici* from New Zealand, Hungary, Norway, Sweden, Canada (Manitoba), and from Minnesota, California, and Washington. two forms are recognizable. It is thought likely that numerous forms of *T. levis* and *T. tritici* can be distinguished by using the proper differential hosts.

The relationship of black chaff disease of wheat to certain physical and pathological characters, L. R. WALDRON (*Science*, 70 (1929), No. 1811, p. 268).—It is regarded as not possible to conclude, on the basis of these data, whether the relationship noted between wheat black chaff and stem rust and between black chaff and bunt has a physiological or a genetic basis. The author believes that the evident antagonism is conditioned by physiological relationships.

Penicillium injury to corn seedlings, H. JOHANN (*Phytopathology*, 18 (1928), No. 2, pp. 259–242).—In seed corn germination tests made at the University of Wisconsin in 1927, a *Penicillium* resembling *P. oraticum* frequently occurred and attacked the seedlings, though some of these reached the fourth-leaf or fifth-leaf stage before dying. Infection occurred in the embryo region and proceeded up the mesocotyl, the hyphae being both intercellular and intracellular. Both the parenchyma and vascular elements were invaded, and the cells were apparently killed in advance of the mycelium. Germination was not seriously affected, but the greatest reduction occurred at 24 and 28° C.

The occurrence of viable cotton root-rot sclerotia in nature, D. C. NEAL (*Science*, 70 (1929), No. 1817, pp. 409, 410).—Viable sclerotia of cotton root rot (*Phymatotrichum omnivorum*) were found under natural conditions living independently and overwintering in the soil of cotton fields in Texas.

Alternaria blight of ginseng, preliminary experiments in the control, J. D. WILSON and H. A. RUNNELS (*Ohio Sta. Bimo. Bul.* 142 (1930), pp. 11–14, fig. 1).—Of various treatments tested as controls for *Alternaria* blight of ginseng, the life history of which is briefly discussed, those containing Bordeaux mixture were highly effective, while copper-lime dust and colloidal copper sulfide were of little value. Bordeaux mixture used alone gave excellent control.

The transmission of potato black-leg by the seedcorn maggot in Maine, R. BONDE (*Phytopathology*, 18 (1928), No. 5, p. 459; *abs. in Maine Sta. Bul.* 349 (1928), pp. 179, 180).—Adult flies (*Hydomyia ciliicrura*) collected in a fallow field produced maggots which caused a seed-piece rot, and this was followed by a development of blackleg in the resulting plants. No such rot and no black-leg occurred in control cultures either without the introduction of flies or with their introduction when not followed by maggots. A similar rot resulted from seed pieces upon which maggots had fed, and also of a collection made from the soil beneath blackleg plants.

Transmission studies with the new psyllid-yellows disease of solanaceous plants, A. M. BENKLEY (*Science*, 70 (1929), No. 1825, p. 615).—During 1926–1928 a very destructive disease of potatoes appeared on the western slope of Colorado, supposedly in association with the common tomato psyllid (*Paratrioza cockerelli*), though apparently not in connection with that alone. Marked characters are an upward cupping of the leaves and a notable dwarfing of the plant. Experimentation shows that the disease is not transmitted through the egg of viruliferous tomato psyllids and then to the nymph stage, also that the feeding of the nymphs alone does not severely check the growth of the tomato plants.

In the observations made with viruliferous nymphs under conditions of caging, the disease was soon transmitted. The insects are thought to bear an important relationship to the progress of the disease, which also carries to the common garden pepper, to the eggplant, and to the ornamental Jerusalem

cherry. The evidence to date indicates that the nature of the disease is that of a virus. Artificial transmission (needle puncture) proved unsatisfactory.

Preliminary observations on sugar cane mycorrhizae and their relationship to root diseases. R. C. PIERRE (*Phytopathology*, 18 (1928), No. 3, pp. 249-261).—In this preliminary account of experiments and observations on the mycorrhizae of sugarcane and their relation to the root disease previously ascribed to Hymeniales, it is stated that diseased or healthy rootlets of cane may be invaded by both a phycomycetous endophyte and a rhizoctoneous endophyte, or by the latter alone. *A-Pythium* sp. probably different from the phycomycetous endophyte may be found associated with it. There are two strains, A and B, of the rhizoctoneous endophyte.

The death of rootlets previous to the normal retardation is supposedly related to the action of the endophytes, and the development of the root diseases results from the loss of equilibrium between the dying rootlets and the new rootlets being formed. Therefore, any cause which hinders the rapid formation of new rootlets, as excessive moisture, severe drought, high acidity or alkalinity in the soil, lack of cultivation, and special physical or chemical character of soils, may be of importance, favoring the outbreak of root diseases. It is thought that growing the cane under the best conditions for development and vitality would tend to maintain the equilibrium between the functional inactivity of diseased rootlets and the formation of new ones.

Apple rust on host tissue in culture dishes. N. J. GIDDINGS and L. H. LEONIAN (*Science*, 70 (1929), No. 1805, p. 126).—Young York Imperial apple leaves sterilized, inoculated with sporidia of *Gymnosporangium juniperi-virginianae*, and placed in culture dishes containing modified Pfeffer's solution plus 0.5 per cent of glucose in good light developed rust in about the same time as in leaves on the tree. The leaves were frequently transferred to a fresh medium. Cutting away portions of the leaf did not affect the disease in the remaining portion. Some specimens were maintained for nearly five months without evidence of deterioration. Pycnosporangia were produced in great abundance, and one apparently normal acium was formed.

Fireblight. F. P. ESHBAUGH ([Oklahoma] *Panhandle Sta., Panhandle Bul.* 12 (1930), pp. 9-11).—General information is presented on the nature and control of fire blight in the pear and apple.

Healthy black raspberry plants. H. C. YOUNG and J. S. SHOEMAKER (*Ohio Sta. Bimo. Bul.* 142 (1930), pp. 3-7, fig. 1).—A general discussion upon the raspberry disease situation in Ohio, with special consideration of the control of virus infections. Setting healthy black raspberry plants near red raspberries resulted in rapid infection of the former. Anthracnose in blacks was checked by cutting out old stems at the time of transplanting and also by spraying with lime sulfur. Healthy stock, reasonable isolation, and general good care are deemed essential to success.

Cranberry false-blossom disease spread by a leafhopper. I. D. DOBOSCHY (*Science*, 70 (1929), No. 1826, p. 635).—Observations and carefully controlled experiments during 1927-1929 are said to have confirmed the results of earlier work (E. S. R., 59, p. 250), proving that *Euscelis striatulus* can and does transmit and spread the virus of cranberry false blossom disease.

Washingtonia palm leaf spot due to *Cylindrocladium macrosporum* n. sp. C. D. SHERRAKOFF (*Phytopathology*, 18 (1928), No. 2, pp. 219-225, figs. 2).—A technical description, with an account as to pathogenicity, is given of a leaf-spotting *Cylindrocladium*, which is named as the new species *C. macrosporum*.

A mosaic disease of gladiolus. L. DODDALL (*Phytopathology*, 18 (1928), No. 2, pp. 215-217, pls. 2).—Observations described indicate definitely a degeneration

disease in gladiolus, the symptoms being marked at all stages in the life of the plant on the corm, leaves, and inflorescence, and resembling characteristically mosaic in other plants. The disease is transmitted through the corm from one generation to the next, eventually killing the plant. Sucking insects may carry the disease.

The crown elongation disease of the peony, H. H. WHEETZEL (*Phytopathology*, 18 (1928), No. 2, pp. 243, 244, fig. 1).—Notice, with brief description, is given regarding an abnormality of peony, supposedly not previously recorded and occurring in the Middle West. The most striking feature is a marked elongation of the crowns (the roots apparently remaining normal), which are greatly multiplied, with a witches'-broom effect.

Bacterial blight of poppy caused by *Bacterium papavericola*, sp. nov., M. K. BRYAN and F. P. McWHORTER (*Jour. Agr. Research [U. S.]*, 40 (1930), No. 1, pp. 1-9, pl. 1, figs. 5).—A bacterial disease, caused by an organism for which the name *B. papavericola* is suggested, was found attacking Shirley and Oriental poppies in Virginia and Connecticut, producing unsightly black spots on the leaves, stems, buds, and seed pods, and in severe cases causing the death of the plants. A description is presented of the cultural and physiological behavior of the pathogene.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Revision of the American chipmunks (genera *Tamias* and *Eutamias*), A. H. HOWELL (*U. S. Dept. Agr., Bur. Biol. Survey, North Amer. Fauna No. 52* (1929), pp. 157, pls. 10, figs. 9).—In the introduction the author deals with the geographic distribution, life history, and habits of the American chipmunks and presents a key for the separation of the genera *Tamias* and *Eutamias* and the two subgenera of the latter. The genus *Tamias* is then dealt with (pp. 11-23), it being represented by a species and five subspecies. The genus *Eutamias*, which is represented by 16 species and many subspecies, is next taken up (pp. 23-137). A bibliography of eight pages is included.

Propagation of aquatic game birds, W. L. MCATEE (*U. S. Dept. Agr., Farmers' Bul. 1612* (1930), pp. II+41, figs. 25).—This and the publication which follows supersede *Farmers' Bulletin 1521*, previously noted (*E. S. R.*, 57, p. 56).

Propagation of upland game birds, W. L. MCATEE (*U. S. Dept. Agr., Farmers' Bul. 1613* (1930), pp. II+61, figs. 35).—This and the preceding publication supersede *Farmers' Bulletin 1521*, previously noted (*E. S. R.*, 57, p. 56).

Fourth International Congress of Entomology, Ithaca, August, 1928.—Vol. II, Transactions, edited by K. JORDAN and W. HORN (*Tring (Herts.)*, Eng.: K. Jordan, 1929, vol. 2, pp. [VIII]+1037, pls. 12, figs. [203]).—This second part of the report of the proceedings of the congress held at Ithaca, N. Y., in August, 1928 (*E. S. R.*, 59, p. 601), includes the following papers that were presented:

Some New Insecticide-Fungicide Combinations, by A. Kelsall (pp. 1-3); The Biological Control of Noxious Weeds, by R. J. Tillyard (pp. 4-9); Remarks on the Problem of the Biological Control of Noxious Weeds, by A. D. Imms (pp. 10-17); Sex-Determination in *Lecanium*, by M. Thomsen (pp. 18-24); The Control of Root-Eating Scarabaeid Grubs in Queensland Cane-Fields, by E. Jarvis (pp. 25-33); The Future of Insect Taxonomy, by W. Horn (pp. 34-51); The Relation of Taxonomy to Other Branches of Entomology, by F. Silvestri (pp. 52-54); Biological Control of a Sugar-Cane Aphid by Transferring Its Native Parasite from the Old to the Young Fields, by E. H. Hazelhoff (pp. 55-61); Weather and the Non-burning of Trash in Borer Control in Porto Rico,

by G. N. Wolcott (pp. 62-64); The Method of Controlling the Sugar-Cane Borer by Attracting Adults to Heaps of Trash, by K. Kunhi Kannan (pp. 65-67); The Pink Bollworm in Haiti, by G. N. Wolcott (pp. 68-72); The Pink Bollworm Situation in Australia, by F. G. Holdaway (pp. 73-80); Complementary Note on the Coccid Monophleboids [trans. title], by P. Vayssi  re (pp. 81-86); On the Use of Calcium Cyanide as an Insecticide in France [trans. title], by R. Regnier (pp. 87-89); The Pink Bollworm (*Platyedra gossypiella* Saunders) in the Sudan, by H. H. King (pp. 90-93); The Status of the Cotton Leaf Worm (*Alabama argillacea* Hbn.) in the West Indies, by H. A. Ballou (pp. 94-96); The Present Status of the Fruit Fly Problem in Mexico, by A. Dampf (pp. 97-99); Some Observations on the So-called European Corn Borer in Japan, by S. Kuwayama (pp. 100-109); The Mass Production of *Trichogramma minutum* Riley and Observations on the Natural and Artificial Parasitism of the Codling Moth Egg, by S. E. Flanders (pp. 110-130); Moth Borer Control in British Guiana, by L. D. Cleare, jr. (pp. 131-137); The European Corn Borer, *Pyrausta nubilalis* H  bn., Its History and Status as a Problem in the Dominion of Canada, by H. G. Crawford (pp. 138-144); The Characteristics and Uses of Petroleum Oil Sprays, by E. R. de Ong (pp. 145-154); Developments in the Fumigation of Citrus Trees, by H. J. Quayle (pp. 155-161); The Most Important Cotton Insects in Turkestan and the Caucasus, by V. V. Nikolsky (pp. 162-164); Lubricating Oil Emulsions for Controlling Insects and Mites on Citrus Trees in Florida, by W. W. Yothers and O. C. McBride (pp. 165-174); The Development of a Control Program for the Mexican Cotton Boll Weevil and Some of Its Results, by W. E. Hinds (pp. 175-180); Hessian Fly Control in the United States, by C. M. Packard (pp. 181-190); The Utilization of Entomophagous Insects in the Control of Citrus Pests, by H. S. Smith (pp. 191-198); Fly Attack and Animal Colouration, by S. Hadwen (pp. 199-202); The Control of Stored Grain and Flour Mill Insects, by G. A. Dean and G. Schenk (pp. 203-228); The Capsid Pests of Fruit Trees in England, by J. C. F. Fryer (pp. 229-236); The Insect Fauna of Thermal Springs, by C. T. Brues (pp. 237-240); Cotton Insect Problems in the United States, by B. R. Coad (pp. 241-247); The Value of Quantitative Methods in the Investigation of Field Crop Insects, with Special Reference to Work with Wireworms and Cutworms, by K. M. King (pp. 248-258); Mosquitoes in China and Their Potential Relationship to Human Disease, by E. G. Faust (pp. 259-267); Damage by Termites Causes Modification of Building Codes, by T. E. Snyder (pp. 268-277); The Mutual Relations of Museums and Expert Specialists, by W. J. Holland (pp. 278-285); The Present Status of the Leopard Moth, *Zeuzera pyrina* L., in the United States, by W. E. Britton (pp. 286-289); A Variable Palearctic Satyrid, by A. Avinoff (pp. 290-293); The European Corn Borer, *Pyrausta nubilalis* H  bn.: Its History and Status as a Problem in the United States, by D. J. Caffrey (pp. 294-302); A Protest against the Use of Abbreviations in Original Descriptions, by J. E. Collin (pp. 303-305); Some Problems in the Control of Underground Insects, by J. W. McColloch and W. P. Hayes (pp. 306-315); The Present Status of Our Knowledge of the Nyssorhynchus Group of Anopheline Mosquitoes, by F. M. Root (pp. 316-321); Some Effects of Temperature and Moisture upon the Activities of Grasshoppers and Their Relation to Grasshopper Abundance and Control, by J. R. Parker (pp. 322-332); Silvicultural Practice in the Control of Forest Insects, by E. N. Munns and P. Coville (pp. 333-341); Two Interesting Neotropical Myrmecophytes (*Cordia nodosa* and *C. alliodora*), by W. M. Wheeler (pp. 342-353); The Economical Value of Ants for Our Forests (pp. 354, 355) and Influence of Temperature on the Number of Eggs in Lepidoptera (pp. 355, 356), both by H.

Eidmann; The Share of the Netherlands in the Development of Entomology in Past Centuries, by J. B. Corporaal (pp. 357-360); Carbohydrate Metabolism in the Honey Bee Larva, by E. Ronzoni and G. H. Bishop (pp. 361-365); The Present Status of Certain Insect Pests under Biological Control in Hawaii, by O. H. Swezey (pp. 366-371); On the Relations between the Color of Silkworms and the Environment, by K. Watanabe (pp. 372, 373); Factors Influencing the Activity of Shade-Tree Insects and the Utilization of These in Control Work, by W. Middleton (pp. 374-381); Codling Moth Control and Removal of Spray Residue from Fruit in South Africa, by F. W. Pettey (pp. 382-388); The Codling Moth Problem in North America, by B. A. Porter (pp. 389-396); Lubricating Oil Sprays and the Pear Psylla Problem, by W. A. Ross (pp. 397-400); The Larch Sawfly and Forestry, by S. A. Graham (pp. 401-407); The Measurement of the Effects of Ecological Factors, by R. N. Chapman (pp. 408-411); An Enquiry concerning the Natural History of the White-Pine Weevil (*Pissodes strobi*), by T. C. Barnes (pp. 412, 413); *Acalla hastiana*, a Destroyer of Osiers in Czechoslovakia, by J. Sámal (pp. 414, 415); An Account of a Collecting Trip to Patagonia and Southern Chile, by F. W. Edwards (pp. 416, 417); Some Poisonous Arthropods of North and Central America, by W. J. Baerg (pp. 418-438); Biological Notes on the Pink Bollworm (*Pectinophora gossypiella* Saunders) in Texas, by F. A. Fenton (pp. 439-447); Local Conditions as Influencing Recommendations for the Control of Sugar-Cane Insects, by T. E. Holloway (pp. 448-451); The Cotton Flea Hopper (*Psallus seriatatus*), by W. V. King (pp. 452-454); The Black Locust-Tree-Scale, *Lecanium robiniarum* Dougl., and the European Corn Borer, *Pyrausta nubilalis* Hübn., a Biological Parallel, by J. Jablonowski (pp. 455-462); Climate and Epidemic Diseases from the Standpoint of Entomology [trans. title], by E. Martini (pp. 463-477); Influence of Color on Mosquitoes and Their Larvae [trans. title], by E. Martini and J. Achundow (p. 475); On the Necessity of a Revision of the Rules of Entomological Nomenclature concerning Groups of Lower Rank than the Specific One, by R. Verity (pp. 479, 480); The Principle of Continuity in Nomenclature, by F. Heikertinger (pp. 481-483); Index to the Literature of the Species of Insects, by E. T. Cresson, jr. (pp. 484-485); On Some Problems of Distribution, Variability, and Variation in North American Siphonaptera, by K. Jordan (pp. 489-499); On the Splitting Influence of the Increase of Entomological Knowledge and on the Enigma of Species, by W. Horn (pp. 500-507); The Japanese Beetle, Its Present Status and Control, by L. B. Smith (pp. 508-515); Periodic Reversal of Heart-Beat in Bombyx and Other Moths, by J. H. Geronld (pp. 516-522); A Quantitative Method of Estimating the Relative Toxicity of Stomach-Poison Insecticides, by F. L. Campbell and R. S. Filmer (pp. 523-538); Experimental Studies on the Effect of "Kambara" Earth upon the Double Cocoon Formation in the Silkworm, by S. Inomata (pp. 534, 535); The Origin of Geographical Varieties in Coccinellidae, by T. Dobzhansky (p. 536); *Glysis ambiguella* Hübn. and *Polythrosis botrana* Schiff. in German Vineyard Districts [trans. title], by F. Stellwaag (pp. 537-542); The Evolution of the Order Odonata, by R. J. Tillyard (pp. 543-545); The Post-Embryonic Development of *Phaenoserphus viator* Hal., a Parasite of the Larva of *Pterostichus niger* (Carabidae), by L. E. S. Eastham (pp. 546-551); Cotton Seed Disinfection as a Control for the Pink Bollworm, *Pectinophora gossypiella* Saund., by R. E. McDonald (pp. 552-554); The Influence Which Geographical Distribution Has Had in the Production of the Insect Fauna of North America, by E. C. Van Dyke (pp. 555-566); The Codling Moth in the Pacific Northwest: Status of Present Spray Practices and Prospects for Improvements in Control Measures, by E. J. Newcomer (pp. 567-570);

The Control of Some Imported Tree Defoliating Insects, by A. F. Burgess (pp. 571-578); Morphological and Oecological Studies on *Chrysopa chrysops* L., by M. Cebeova (pp. 579-581); Adaptations Which Hinder or Prevent Inbreeding in Insects, by E. B. Poulton (pp. 582-588); Contribution to the Interpretation of the Cephalic Segments of Arthropoda, by K. L. Henriksen (pp. 589-594); Permian Entomofauna of North Russia and Its Relation to That of Kansas, by A. B. Martynov (pp. 595-599); The Role of Function in Taxonomy and Its Relationship to the Genitalia in Insects, by F. Muir (pp. 600-604); The Insect Carrier of *Onchocerca volvulus* in Liberia, by J. Bequaert (pp. 605-607); Pea Aphid Investigations, by J. E. Dudley, jr., E. M. Searls, and A. Weed (pp. 608-621); The Future of Zoological Nomenclature, with an Appendix: History of Rules re Designation of Genotypes, by C. W. Stiles (pp. 622-645); On the Use of Quadrats in Determining the Occurrence of Forest Insects [trans. title], by U. Saalas (pp. 646-656); The Selection of Family Names, by A. L. Melander (pp. 657-663); The Theory of Nomenclature, by C. H. Kennedy (pp. 665-672); The Problem of Arsenical Residues: Importance of Spray Deposits from the Standpoint of Public Health, by H. A. Kuhn (pp. 673, 674); The Problem of Arsenical Residues: The Situation in Different Apple-Growing Areas and Results of Investigations Relative to the Production of Apples to Meet Market Requirements, by L. Childs (pp. 675-687); Forum on Problems of Taxonomy: Types, by W. J. Holland (pp. 688-693); Forum on Problems of Taxonomy: Discussion on Types, by J. Waterston (pp. 695-699); A Comparison of the Systems of Nomenclature That Have Been Applied to the Radial Field of the Wing in the Diptera, by C. P. Alexander (pp. 700-707); Anopheline Mosquito Investigations in California, by W. B. Herms (pp. 708-721); Communication among Termites, by A. E. Emerson (pp. 722-727); Some Recently Proposed Stomach Insecticides, a Review of the Patent Literature, by R. C. Roark (pp. 728-736); The Development of Entomological Science in Egypt, by H. C. Efflatoun (pp. 737-742); The Destruction of Injurious Insects Before the Sowing Season of Sugar-Beet, by F. G. Rambousek (pp. 743-745); Agricultural Entomology and the Insect Enemies of Cultivated Plants in Bulgaria [trans. title], by P. Tchorbadjief (pp. 746-756); Septicemia of the Honeybee, by C. E. Burnside (pp. 757-767); The Oil Rape Beetle (*Entomoscelis adonidis* Pall., Chrysom.) in Bulgaria [trans. title], by P. Tchorbadjief (pp. 768-770); On the Sound Apparatus of the Flea [trans. title], by G. Enderlein (pp. 771, 772); Investigations of the Fauna of a Dying Tree (pp. 773-780) and Studies in the Fauna of the Soil in Swedish Forests (pp. 781-792), both by I. Trägårdh; Enumerations in the Knowledge of the Structure of Insect Wings [trans. title], by O. E. Imhof (pp. 793, 794); Forum on Problems of Taxonomy: Determinations, by I. B. Corporaal (pp. 795, 796); Forum on Problems of Taxonomy: Collections, by R. Jeannel (pp. 797-800); Remarks on the Insect Collections in the Museum of the California Academy of Sciences, by E. P. Van Duzee (pp. 801, 802); The Locust Question in Soviet Russia (pp. 803-812) and Life-Zones in Russia and Their Injurious Insects (pp. 813-820), both by I. N. Filipjev; On Mimicry and Its Related Problems [trans. title], by F. Heikertinger (pp. 821-831); On *Doryloxenus* from Java and Wasmann's Hypothesis of the Host-Change of This Genus of Beetles, by N. A. Kemner (pp. 832-835); Chemical Methods of Insect Control in U. S. S. R. (pp. 836-847); Control of Acrididae in U. S. S. R. (pp. 848-856), and Researches in Insect Toxicology (pp. 857-864), all by I. A. Parfentjev; Preliminary Observations on the Pine Tip Moth (*Rhyacionia frustrana* Comst.) on Southern Pines, by P. C. Wakeley (pp. 865-868); Insect Inhabitants of the Upper Air, by E. P. Felt (pp. 869-872); Polyem-

bryony in Insects, by R. W. Leiby (pp. 873-887); A Brief Account of the Present Organization of Agricultural Entomological Work in France [trans. title], by B. Trouvelot (pp. 888-896); Preliminary Report on the Citrus Scale-Insects of China (pp. 897-904) and On Postembryonal Development of Japygidae (Thysanura) (pp. 905-908), both by F. Silvestri; Taxonomic Observations on the American Saturnioids [trans. title], by E. L. Bouvier (pp. 909-916); A New Method of Making Microscopic Aphid Preparations, by W. Roepke (pp. 917, 918); The Significance of Odonate Larvae for Insect Phylogeny, by P. P. Calvert (pp. 919-925); A Cold Steam Orchard Spraying Machine, by R. W. Leiby (pp. 926-928); Arthropods in the Transmission of Tularemia, by E. Francis (pp. 929-944); Environmental Factors and Mosquito Breeding, by W. Rudolfs (pp. 945-959); The Department of Apiculture of the Moscow District Agricultural Experimental Station and Its Work on the Role of the Honey Bee in Pollination of Agricultural Plants, by A. F. Gubin (pp. 960-963); Present Status of Methods and Policy of Controlling Insects Injurious to Agriculture and Forestry in U. S. S. R., by A. P. Adrianov (pp. 964-975); Instrumental Insemination of Queenbees, by L. R. Watson (pp. 976, 977); The Origin of the Hawaiian Odonata Fauna and Its Evolution within the Islands, by C. H. Kennedy (pp. 978-981); Field Insects of Russia, with Special Reference to Insects Introduced into America and Their Coefficient of Injury, by D. N. Borodin (pp. 982-991); The Relation of Windfalls to Bark Beetle Epidemics, by J. M. Miller (pp. 992-1002); The Regional Museum and One of Its Problems by E. P. Van Duzee (pp. 1003, 1004); Studies on the Etiology of European Foulbrood of Bees, by A. G. Lochhead (pp. 1005-1009); Variability of the Honeybee Tongue Biometrically Investigated, and Practical Questions Connected with the Problem of the Selection of the Honeybee, by W. W. Alpatov (pp. 1010-1019); Some Remarks on the Keys of the European Chalcids, by J. P. Kryger (pp. 1020-1023); Remarks on the Morphology and Geographical Distribution of Neohydrophilus (Coleoptera, Hydrophilidae), Especially the American Species, by A. d'Orchymont (pp. 1024-1028); Can We Increase the Usefulness of the Egg Parasite *Trichogramma minutum* Riley? by W. E. Hinds and H. Spencer (pp. 1029-1035); and Mississippi Methods of Enforcing Quarantines against Cotton Pests, by R. W. Harned (pp. 1036, 1037).

Studies of insect pests (*South Carolina Sta. Rpt. 1929, pp. 57-70, 92-94, 107, 108, figs. 4*).—The asparagus beetle, found in the State for the first time, caused noticeable damage in several counties. Reference is made to the boll weevil, with which more successful poisoning was conducted than in any previous year; to the Mediterranean fruit fly, for which an active search was made; the cotton flea hopper, which was only present in small numbers; and thrips injury to cotton. The onion thrips attacked cotton seedlings, and *Frankliniella fusca* Hinds was active.

The Mexican bean beetle caused its greatest damage in the State during the early part of the season of 1929. Magnesium arsenate was the only arsenical that was completely effective. With the increased infestation of the pest pyrethrum soap sprays failed to give as good results as magnesium arsenate. The emergence of the beetle from hibernation was far greater than in any other year since the insect entered the State. In some of the test cages nearly 50 per cent of the beetles emerged in the spring, 15 per cent having been the average pest emergence.

The pigeon fly, *Lynchia maura* Bigot, which sucks the blood from squabs and adult pigeons, has become so abundant in the warm months that it is a real menace in many pigeon plants. It is pointed out that the frequent cleaning of pens and nests and destroying the pupae is one of the most effective methods of holding it in check.

Two new fruit pest problems face the fruit growers of the State in the giant root borer of apple and the oriental fruit moth (*Laspeyresia molesta* Busck). The larvae of the giant root borer were found in the roots of oak trees while clearing land, and it is pointed out that young orchards should not be planted in newly cleared land, especially where oak has been growing. The oriental fruit moth was found causing a loss in peach orchards in nearly all sections of the State. In one orchard near Greenville it prevented the sale of 181 per cent of the fruit. The egg parasite *Trichogramma minutum* Riley was found active in checking the pest, particularly late in the season, but the larval parasite *Macrocentrus ancylicora* Roh., effective in some States, has not as yet appeared in South Carolina.

In corn variety experiments at Florence ears of corn showed a high infestation and damage, 97.3 per cent having been entered by the corn ear worm, of which 79 per cent had been damaged by it. The examination revealed 57.46 per cent of the infested ears to have been entered by the corn ear worm, 33 per cent by the rice weevil, 27.33 per cent by the Angoumois grain moth, and 51.73 per cent by flour beetles. Varietal differences in the percentages of infestation by the rice weevil were marked, Brunson giving the least infestation, closely followed by Coker Ellis on 2 years' data. The details of infestation of the 15 varieties of corn in 1928 are presented in tabular form.

In studies of the southern stalk borer a partial third generation was detected. The first of the three periods of adult emergence occurred in late May, the second from June 30 to July 27, and the third from August 18 to September 13. The 42 pupae observed in June and July required an average pupal period of 10.71 days. In 34 cages in July the average oviposition was 390.7 eggs and in 17 cages in August and September an average of 346.3 eggs. The maximum number recorded was 623, with two other cages producing 600 eggs each. Infestation counts ranged upward to 81 per cent of stalks in sweet corn. The Florence corn variety test plats showed 43 per cent of the stalks infested, with the borer population 640 per 1,000 stalks. In a study made to determine the extent to which the infestation of the southern stalk borer reduced the yield 456 of 1,492 stalks examined in October showed injury, 126 were not infested, and the remaining 910 contained a total of 1,306 borers.

The fall army worm caused a widespread and severe injury to late corn. Reference is made to the lesser corn stalk borer, which caused considerable damage to corn, to the control of the bollworm in tomato, and to a faunal survey.

Data are also given on work at the Pee Dee Substation where a study of boll weevil movement by means of screen traps was continued (E. S. R., 60, p. 755). The first weevils began to move in the fields during the week of August 11, and general migration began on August 20. There was not such a massive movement of weevils as in 1928. In poisoning work the presquare application of 1:1:1 calcium arsenate-molasses mixture gave good gains over the untreated cotton. Of 22,000 boll weevils released in 52 cages from September 1 to November 17, 1928, a total of 3,123 weevils, or 14.2 per cent, emerged during the season.

A brief reference is also made to the survey of early poisoning on 67 farms in Florence and Darlington Counties and to corn insects.

[Report of work in entomology at the Texas Station] (*Texas Sta. Rpt. 1928, pp. 42-49*).—In a study of the ingestion of poison by the boll weevil it was found that various portions of the cotton plant after a field application of calcium arsenate dust have the following relative importance for the five days after application: Stems 2.2, fruit (squares and bolls) 13.2, and leaves

34.6. These results were obtained in experiments in which 50 boll weevils were used per plant during the months of July and August.

The station began studies of the pink bollworm in the Big Bend district of the Rio Grande for the first time in 1928, under a cooperative agreement with the U. S. D. A. Bureau of Entomology, and with headquarters at Presidio. With a view to determining whether or not the moths fly or can be carried long distances by air currents, under what conditions this occurs, and from what centers the species spread, 17 isolated plantings of cotton and 2 of okra from 6 to 65 miles distant from the nearest cotton fields were made within the quarantined area. The work was supplemented by weekly records of infestation in cotton along the Rio Grande and by airplane collections of moths. In work conducted to determine the best methods to use in field clean-up operations it was found that a very high mortality resulted from winter irrigation following winter burial of infested material, and that winter irrigation or winter burial alone was not effective. Of the overwintering larvae, 96 per cent were found either in the forms on the cotton plants or in the surface trash on the ground, and 4 per cent in the soil or on the tap roots of the plants. The emergence of moths from bolls on or in the soil at Castolon in Brewster County extended from March 27 to July 2, 1928, the heaviest emergence occurring from April 14 to 30.

Active work with the cotton bollworm was commenced in the fall of 1927 and carried on during 1928 in 5 counties. The boll weevil survival in 1928 at College Station was 0.42 per cent, the smallest ever recorded there, and the period of emergence was from March 1 to April 17.

It was demonstrated in the fall of 1927 that ants affecting citrus trees can be controlled by disturbing the nest and dusting with calcium cyanide or spraying with carbon bisulfide.

Promising results were obtained by the use of lime sulfur or sulfur wash in controlling fire ants on the trunks of young citrus trees. Encouraging results were obtained from the use of dry sulfur or a sulfur naphthalene mixture against the tomato suck fly, which has become a problem in southwestern Texas.

In disease inspection work with bees American foulbrood was found in 1.5 per cent of the 34,761 colonies examined.

Reference is made to the rodent control work under way in the State.

In experimental control work with plant lice on truck crops, conducted largely in Galveston County with the turnip aphid, nicotine sulfate and Destruxol were about 50 per cent effective. A 4 per cent nicotine dust applied under favorable conditions with a hand duster gave an average kill of 84 per cent. Fumigation with hydrogen cyanide resulted in a complete kill, and experimental work with various covers for confining the gas in fumigating the plants is under way.

Means of controlling the turnip root louse, *Pemphigus populi transversus* Fitch, which causes considerable damage, were investigated but no definite results were obtained. Four species of tenebrionid beetles were found attacking melons on Galveston Island in May, the most abundant of which were *Blapstinus pulverulentus* and *B. fortis*. Under laboratory conditions poison bait gave a high percentage of kill, ranging from 70 to 98 per cent. Molasses and vanillin formed the most powerful attractive substances tried.

The California red scale continued to be the major pest of citrus in the Lower Rio Grande Valley and is rapidly becoming more prevalent throughout the whole fruit-growing section. Fumigation with calcium cyanide dust is said to be satisfactory, but reinfestation occurring the latter part of July and in August

caused much damage to the fruit before picking time. Oil sprays applied in May and July were more effective in controlling this scale than these same materials applied at other times. The indications are that oils of low volatility are somewhat superior to the lighter oils in effectiveness in killing the scale.

[Notes on economic insects] (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 821-824).—The contributions here presented include the following: Sterility in the San Jose Scale, by E. J. Newcomer and M. A. Yothers (pp. 821, 822); The Storage of Liquid Lime Sulfur in Steel Drums, by H. S. Swingle (p. 822); Sulfur a Repellent to *Trichogramma minutum*, by C. H. Alden (p. 822); Geraniol Bait as a Possible Attractant for Cicadidae, by N. Tischler (p. 823); Insect Nutrition and Metabolism, by E. F. Phillips (p. 823); Notes on Experiments on Ovipositional Chemotropism, by J. W. Lipp (pp. 823, 824); and Relative Covering Power of Miscible Oil and Oil Emulsion, by O. I. Snapp and H. S. Swingle (p. 824).

Insect pests affecting commercial crops in the Lower Rio Grande Valley, S. W. CLARK (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 789-792).—This account deals with the insect enemies of cotton, truck crops, and citrus in the Lower Rio Grande Valley of Texas, the nature of control measures practiced, and some of the experimental results obtained at the Lower Rio Grande Valley Experiment Station at Weslaco, Tex.

Preliminary studies regarding physical qualities and distribution of sodium silicofluoride dusts, W. E. HINDS (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 768-773).—This is a contribution from the Louisiana Experiment Stations, reporting upon field experimental work with sodium silicofluoride dust applications applied to corn and sugarcane for control of the sugarcane borer during the seasons of 1925, 1926, and 1927. These tests have shown that there exists in different brands and mixtures of these dusts such great variations in dusting qualities as to indicate that physical texture, free flowing qualities, lightness, etc., may be as important as its chemical character in determining the value of a dust for insecticidal purposes.

Compatibilities of insecticides.—I, Fluosilicates and cryolite with arsenates, R. H. CARTER (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 814-818).—In order to determine the compatibilities of arsenates with fluosilicates and cryolite the materials were mixed in the ratio of 1 lb. of each to about 46 gal. of water, followed by mechanically shaking for $1\frac{1}{2}$ hour, allowing to stand for 24 hours at 20° C., and analyzing portions of the solutions for soluble arsenic and acidity.

It was found that lead arsenate may be mixed in water with the fluosilicates of sodium, potassium, barium, and calcium without the formation of excessive amounts of soluble arsenic. With the exception of the calcium fluosilicate compound, which contained a relatively small percentage of calcium fluosilicate, the five other arsenates, namely, calcium, manganese, magnesium, aluminum, and barium, were largely decomposed by the presence of fluosilicate. Magnesium and aluminum arsenates were very slightly affected, but calcium, manganese, and barium arsenates were greatly decomposed when mixed with barium fluosilicate in water. The presence of cryolite seemed to inhibit the formation of soluble arsenic with all the arsenates used. None of the arsenates developed excessive amounts of soluble arsenic on standing in tap water for 24 hours.

Lead arsenate not injurious to poultry (*Calif. Dept. Agr. Mo. Bul.*, 18 (1929), No. 11, p. 590).—In experiments conducted by A. L. Shealy in which lead arsenate was used in drinking water for poultry and for soaking the feed given to the chickens, no ill effect resulted from the standard lead arsenate

spray as used in the Mediterranean fruit fly eradication work, namely, 8 lbs. to 200 gal. of water.

Life history, habits, and control of the Mormon cricket, F. T. COWAN (*U. S. Dept. Agr., Tech. Bul. 161 (1929), pp. 28, figs. 24*).—This is a report of studies of the Mormon cricket commenced by F. W. Boyd in Hot Springs County, Wyo., in 1923 and continued until 1924, and of similar studies conducted by the author in western Montana in 1926 and 1927 and in northwestern Colorado in the spring and summer of 1928 in cooperation with the Colorado State entomologist.

This cricket is essentially an insect of the mountains, but is known to be present in many of the States occupying the Great Plains, extending across the United States from Texas to Minnesota. While given the name of a cricket because of its resemblance to the common black cricket, especially in its chirping noises, the pest is a wingless, long-horned grasshopper. It naturally inhabits high, rugged hills in mountainous country, from which it migrates from time to time into cultivated valleys to damage crops. It usually occurs in bands varying in extent from a small area up to a square mile or more. The bands are very dense, there being often from 100 to 500 to the square foot. In general, cereals are injured by the pest more than are other crops, although alfalfa, garden crops, and small fruits are severely attacked.

The Mormon cricket reaches the adult stage early in summer, its eggs being laid in the summer and in the early fall and hatching in the following spring. Between the stages of the egg and the adult are 7 nymphal stages, in all lasting from 75 to 90 days. When hatched from the egg and after each molt the insect is light tan in color; on exposure to the air it soon turns black in the first three instars, but with some variation in color in the remaining four. Although the insect is wingless, rudimentary wings develop and become visible in the seventh instar and in the adult. The adult stage is attained in the early part of the summer, usually between the middle of June and the middle of July. At the age of 10 days or 2 weeks the female begins egg laying, which is continued to the end of the summer or early in the fall. The duration of the life of the adult seems to be not well understood. The insect is hardy and frequently makes good use of shelter as a protection against cold and inclement weather, but reducing the likelihood of longevity are its pronounced cannibalistic habit and a great number of predatory enemies. The food of the Mormon cricket includes a considerable number of uncultivated plants, bitter-root and several kinds of mustard being especially favored, and practically all kinds of field and garden crops.

Its insect enemies include the egg parasite *Sparaisson pilosum* Ashm. and a predatory wasp, *Palmodes laeviventris*, which stings the crickets, paralyzing them, and drags them to its burrow, where they later serve as food for the young of the wasp. Artificial control by means of poisoned bait has not been found reliable, although some good results have been obtained with a poisoned bran mash. Encouraging results have been obtained from experiments with powdered arsenites of sodium and calcium, mixed in proper proportions with hydrated lime and dusted over the swarms. Mechanical control by artificial barriers is completely effective in stopping migrations of the cricket and in destroying the insects themselves, but the barriers are expensive and difficult to handle. Several types of barrier have been tried and found successful. They were constructed of various materials, such as metal, metal and wood, and wood and oilcloth.

Observations on some of the more important insects captured in codling moth trap baits, M. A. YOTHERS (*Jour. Econ. Ent., 22 (1929), No. 5, pp.*

805-811).—This is a report upon the insects collected in trap baits in orchards in the Yakima Valley of Washington, the details of which are given in tabular form.

The uneven distribution of *Heliothis obsoleta* (Fabricius) on cotton in Texas, R. K. FLETCHER (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 757-760).—In this contribution from the Texas Experiment Station some of the possible causes for the uneven distribution of the bollworm on cotton are briefly considered. These include rainfall, soil, the possible attraction of the moths to cotton plants because of an increased secretion of nectar in certain localities, and their possible attraction to cotton covered with honeydew.

Some possible means of control of the damage caused by the cotton leaf worm moth to the fig, F. M. HULL (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 792-796).—In this contribution from the Texas Experiment Station it is pointed out that the damage to the figs is caused by periodic settling of swarms of moths on the fruit, with souring of the figs as a result. Several poison baits tested gave promise of considerable success in the control of the pest. The repellents tested were not as effective.

Technique employed in transferring parasites of the oriental peach moth (*Laspeyresia molesta* Busck), F. M. DANIEL (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 801-805).—This is a contribution from the New York State Experiment Station, in which the author reports upon the results of two methods of handling parasitized oriental peach moth (*L. molesta*) material in transferring *Macrocentrus ancylivora* Roh.

Further tests of cutworm bait poisons, C. LYLE (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 797, 798).—Experiments were conducted in which 360 worms of five species were placed in individual boxes containing the same food on which they were feeding when collected. It was found that a poisoned bait made of 1 lb. of Paris green and 50 lbs. of wheat bran gave an average kill of 95 per cent in 24 hours, in comparison with 53.6 per cent kill with a sodium fluosilicate bait of the same proportions. When the sodium fluosilicate was completely dissolved in water before adding to the bran, the mortality was 44.8 per cent in 24 hours.

Effects on the cotton plant of the feeding of certain Hemiptera of the family Miridae, K. P. EWING (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 761-765, pls. 3).—In experiments with six hemipterous insects belonging to the family Miridae (the cotton flea hopper, tarnished plant bug, *Adelphocoris raptaeus*, *Creontiades debilis*, *Pocilloscytus basalis*, and *Ligus apicalis*), the author proved that each species when allowed to feed on cotton plants caused the young squares to shed or become blasted, produced lesions along the main stem, branch stems, and leaf petioles, and caused mutilations of leaves.

The value of spring emergence records on the cotton flea hopper, *Psallus seriatus*, H. J. REINHARD (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 765-768).—This is a contribution from the Texas Experiment Station. The author finds that the occurrence of destructive cotton flea hopper infestations on cotton apparently are determined by the status of the current crop at the time when the peak of spring emergence of the insect occurs.

Experiments on the relation between the location of cotton fields and the intensity of boll weevil infestation the succeeding season, E. W. DUNNAM (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 750-756, figs. 3).—The author finds that data collected during 1928 at Tallulah, La., following the floods of 1927 with attendant restriction of cotton culture, tend to show that there is no relation between the distribution of the boll weevil infestation in 1928 and the location of the cotton plantings in 1927.

Hessian fly control in Indiana, W. H. LARRIMER and C. M. PACKARD (*Indiana Sta. Circ.* 167 (1929), pp. 12, figs. 6).—This account, the result of cooperation between the U. S. D. A. Bureau of Entomology and the station, reviews briefly the life history of the Hessian fly, cautions the wheat growers of the State against a tendency to sow too early, and presents data showing that in the long run wheat sown on or soon after the safe date produces better yields and suffers less from the fly than earlier sown wheat.

The plant louse problem of the Texas Gulf coast, F. M. HULL (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 774-777).—This is a contribution from the Texas Experiment Station.

Peach tree borer, F. P. ESCHBAUGH ([Oklahoma] *Panhandle Sta., Panhandle Bul.* 12 (1930), pp. 11-13).—A brief reference is made to the occurrence of the peach tree borer, the injury which it causes, and means of control by the use of paradichlorobenzene.

Results of further investigations with paradichlorobenzene around peach trees, with special reference to injury, O. I. SNAPP and H. S. SWINGLE (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 782-785).—High temperatures in Georgia during October, 1928, caused a rapid generation of paradichlorobenzene gas, and as a result peach trees 1, 2, and 3 years old were severely injured. It appears that some will die as a result of the treatment. Paradichlorobenzene dissolved in gasoline did not control the peach borer.

A study of the insecticidal properties of soaps against the Japanese beetle, P. A. VAN DER MEULEN and E. R. VAN LEEUWEN (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 812-814).—This is a report upon the use against the Japanese beetle of a number of sodium and potassium soaps. The results, the details of which are presented in tabular form, show a surprising variation.

The influence of external temperature on the hive temperatures during the summer, W. E. DUNHAM (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 798-801, fig. 1).—This is a report of studies on the variations in temperature occurring within different regions of a hive during summer and of the cause.

[Report of apicultural work at the Texas Station] (*Texas Sta. Rpt.* 1928, pp. 87, 88).—Records obtained in the studies of the behavior of bees indicate that they become inactive as soon as the temperature reaches 94° F. and the relative humidity is below 50%. In a study made of the poisoning of bees from cotton which has been sprayed or dusted with insecticides, it appears that the bees have been killed only where the poison was applied to the cotton together with a sweet adhesive mixture or where honeydew was present upon the leaves.

ANIMAL PRODUCTION

Further studies of the energy metabolism of cattle in relation to the plane of nutrition, E. B. FORBES, W. W. BRAMAN, M. KRISS, ET AL. (*Jour. Agr. Research [U. S.]*, 40 (1930), No. 1, pp. 37-78, figs. 4).—In order to check the results of a previous study at the Pennsylvania Institute of Animal Nutrition (El. S. R., 60, p. 359), a series of 15 experiments was conducted with 2-year-old steers by direct heat measurements checked by indirect calorimetry to determine energy metabolism in relation to the plane of nutrition, particularly as related to the problem of the method of determining the net energy values of feeding stuffs. Energy metabolism was studied at the following planes of nutrition: Fast, half of the maintenance requirement, maintenance, half more than maintenance, two times maintenance, two and one-half times maintenance, and three times maintenance. The ration used was made up of corn meal and alfalfa hay, equal parts, except in one period with each of the two steers when alfalfa hay alone was fed.

Using the heat production of the fourth day of fast as a base, the heat increment was found to increase slowly between fast and maintenance and much more rapidly above maintenance, but with a decrease in rate of rise between two and three times maintenance. The curve of heat production in relation to the plane of nutrition thus found was a reverse curve.

Two factors, the waste heat of utilization of body nutrients katabolized and a theoretical minimum base value including no such waste, were considered to make up the heat production of fast. The increase in heat production in relation to increased food consumption was interpreted to be made up of the increased concentration of metabolites circulating in the blood; the change in the proportions of protein, fat, and carbohydrate katabolized, with the increase in the katabolism of food nutrients and decrease in the katabolism of body nutrients; the energy expense of synthesis of body nutrients; and the decreased metabolizability of the food at the higher planes of nutrition. The increase in heat production between the lower planes of nutrition was considered to be less than the true energy expense of food utilization by the amount of the waste heat of utilization of body nutrients katabolized.

For the most practical means of deriving a system of energy values of feeding stuffs, the authors conclude that the method and viewpoint of Armsby, modified by the adoption of the standardized, directly observed heat production of fast as the base value in the energy metabolism of cattle and as the measure of maintenance requirement of net energy and by the recognition of the facts as to the relation of energy metabolism to the plane of nutrition, must be followed.

The authors suggest a standard condition for determining the heat production of fasting cattle, as follows: "The heat production of the first day—beginning either in the morning or the evening—following the appearance, within the animal, of a status of metabolism characterized by the nonprotein respiratory quotient of fat; this measurement to follow a preparatory feeding at the plane of energy equilibrium."

The studies have shown that the most difficult problem in net energy determination is the separation of the net energy of grain from that of roughage. Methods of computing results of net energy determinations are discussed, and a standard schedule for such experiments is proposed.

Biological values and supplementary relations of the proteins in alfalfa hay and in corn and sunflower silage, J. SOTOLA (*Jour. Agr. Research* [U. S.], 40 (1930), No. 1, pp. 79-96).—Metabolism studies with lambs were conducted at the Washington Experiment Station to determine the biological values of the proteins in alfalfa hay, sunflower silage, and corn silage when fed singly or in combinations. Experimental periods were of 10 days duration, preceded by a 10-day preliminary period. The order of feeding was as follows: (1) Nearly nitrogen-free rations, (2) alfalfa hay, (3) sunflower silage, (4) 1 part alfalfa hay and 3 parts sunflower silage by weight, (5) corn silage, (6) 1 part alfalfa hay and 3 parts corn silage by weight, and (7) nearly nitrogen-free rations.

Biological values of 56, 94, and 67 were found for the proteins in alfalfa hay, corn silage, and sunflower silage, respectively. The combination of alfalfa hay and corn silage had a value of 81, while the mathematical mean calculated on the basis of nitrogen that each contributed was only 64. On the other hand, the combination of alfalfa and sunflower silage had a value of 62, with a mathematical mean of 58. These results indicate the superior supplementing values of the proteins of alfalfa and corn silage as compared with those of alfalfa and sunflower silage.

Commercial feeding stuffs, H. R. KRAYBILL ET AL. (*Indiana Sta. Circ.* 165 (1929), pp. [2]+36, fig. 1).—A report of 2,787 samples of commercial feeding

stuffs, collected for official inspection and subjected to either microscopic examination or to chemical analyses during the year 1928, is given (E. S. R., 60, p. 68). Rules governing the registration of mineral feeds, explanation of terms used in analyses, definitions of feeding stuffs, average analyses of common cereals and by-products, and the standing of each feed manufactured on the basis of compliance with the Indiana Feeding Stuffs law are included.

The selection of breeding sires, W. C. THOMPSON (*New Jersey Stat. Hints to Poultrymen*, 18 (1929), No. 3, pp. 4, fig. 1).—The characteristics of good breeding sires as to health, type, and pedigree are discussed by the author.

The relative value of high-grade and low-grade calves marketed as two-year-old steers, E. A. LIVESAY (*West Virginia Sta. Bul.* 225 (1929), pp. 12, figs. 4).—High-grade Hereford calves were divided into 2 lots of 6 head each, and low-grade calves were similarly divided. These lots were fed through 2 winter periods of 154 and 140 days in dry lot and were on pasture for 2 seasons of 236 and 140 days, respectively. While in dry lot the calves received a basal ration of corn silage and mixed hay. Cracked corn was fed during the first winter season, but no grain other than that in the silage was fed the second season. One lot of each quality received cottonseed meal and the other lots linseed oil meal. While on pasture the animals received no additional feed.

During the first winter there was practically no difference in the gains of the high- and low-grade calves, but the lots receiving linseed oil meal gained about 12 lbs. more per head than the lots receiving cottonseed meal. The low-grade calves, regardless of their winter ration, made better gains during the first pasture season than did the high-grade calves. As yearlings in the feed lot the high-grade animals made slightly larger gains than did the low-grade animals, and during this feeding period a slight advantage was noted for the steers fed cottonseed meal. On grass the second summer the lots making the greatest winter gains made the smallest pasture gains.

At the time the animals were sold the low-grade cattle were worth only three-fifths as much as the high-grade cattle. The high-grade calves developed into steers with a higher dressing percentage, their carcasses were smoother and thicker, and the fat was of a more desirable color than the carcasses of the low-grade calves.

The frozen and chilled meat trade (London: Gresham Pub. Co., 1929, vols. 1, pp. IX+267, pls. 15, figs. 11; 2, pp. IX+273, pls. 5, figs. 19).—This is a practical treatise in two volumes, prepared by specialists in the meat trade, dealing with the status and practices of this trade in the large exporting countries and with the marketing, refrigeration, meat inspection, and transport laws in so far as they relate to this industry.

Determination of age of water buffaloes by the eruption of temporary and permanent incisors, V. VILLEGAS (*Philippine Agr.*, 18 (1929), No. 6, pp. 371-378, fig. 1).—Based on observations made on 55 animals, of which 21 were carabaos, 13 Indian buffaloes, and 21 Indian buffalo grades, the College of Agriculture, University of the Philippines, has developed a method for calculating the age of the animals by determining the period at which the deciduous or temporary incisors erupt and when they are replaced by permanent teeth.

[Experiments with sheep at the Texas Station] (*Texas Sta. Rpt.* 1928, pp. 28-30, 31, 32, 34, 35, 36-39).—Further results of studies with sheep (E. S. R., 59, p. 764) are briefly noted.

Type in Rambouillet sheep.—During the year 1927-28, 140 C type ewes produced fleeces with an average staple length of 2.3 in., while the staple length of 45 B type ewe fleeces averaged 2.01 in. The average grease weight

of fleeces of C type ewes was 8.33 lbs. with a clean yield of 3.45 lbs., and the corresponding weights for B type fleeces were 9.25 and 3.54 lbs., respectively. These figures indicate that under the same range conditions C type sheep produce fleeces with a shrinkage of at least 2 or 3 per cent under those of B type fleeces.

Body and fleece weights of Rambouillet sheep.—Records of the average body weight and fleece weight of Rambouillet ewes from birth have been maintained during the period 1919-1928. These records show that the period of growth and development extends over a period of several years. Between 2 and 5 years of age the weight of fleeces remained practically constant, with a maximum weight reached between 2 and 4 years of age. The average fleece weight for 530 head (all ages) of Rambouillet ewes was 9.01 lbs.

Angora goat body and fleece weights.—Results similar to those noted in the previous experiment were observed with Angora goats. The average fleece weight for 1,086 head (all ages) of Angora goats was 6.16 lbs.

Methods of preparing sorghum roughage and grains for feeding to fattening lambs.—In this test 3 lots of 25 lambs each, averaging 61 lbs. per head, were fed for 84 days. Lot 1, fed whole threshed milo and chopped alfalfa hay, made an average daily gain of 0.259 lb. per head. The lambs required 4.11 lbs. of grain and 4.31 lbs. of hay per pound of gain. Lot 2 on whole threshed milo, cottonseed cake screenings, and chopped alfalfa hay gained at the rate of 0.285 lb. per head daily, and required 3.76 lbs. of milo, 0.42 lb. of cottonseed cake screenings, and 3.97 lbs. of hay per pound of gain. Lot 3 received the same ration as lot 2 except that ground threshed milo replaced the whole milo. These lambs gained at the rate of 0.304 lb. per head per day, and required 3.52 lbs. of milo, 0.30 lb. of cottonseed cake screenings, and 3.71 lbs. of hay per pound of gain.

A study of the adaptation of the Corriedale sheep to southwest Texas conditions.—During 1927-28, 2 Corriedale rams produced 1.3 lbs. less scoured wool than did a Rambouillet ram. Approximately 0.5 lb. more scoured wool per head was produced by 38 Corriedale ewes of all ages than by 185 Rambouillet ewes. On the basis of mature weight 3 Corriedale rams averaged 134.8 lbs. as compared with 167 lbs. for 29 Rambouillet rams, while 35 Corriedale ewes averaged 94.4 lbs. and 162 Rambouillet ewes averaged 112 lbs. As yearlings 2 Corriedale ewes averaged 81 lbs., and 51 Rambouillet ewes 83.5 lbs. The average birth weight of 18 Corriedale ewe lambs was 9.53 lbs., of 92 Rambouillet ewe lambs 9.86 lbs., of 16 Corriedale ram lambs 10.44 lbs., and of 77 Rambouillet ram lambs 10.45 lbs. The percentage lamb crop of 176 Rambouillet ewes was 96.59, and of 36 Corriedale ewes 97.22.

Shearing sheep once v. twice a year.—Over a period of 8 years sheep sheared twice a year produced approximately 0.75 lb. more wool per head annually than those sheared once a year. However, this small difference was of no significant advantage since two shearings a year double the cost of the operation, the fall shearing comes at a time when the blowfly pest is active, and usually fine staple wool commands a rather large premium over the fine clothing wool. The number of times the sheep were sheared had little or no effect on the ensuing year's lamb crop, nor upon the death losses.

Cost of wintering pregnant ewes (South Carolina Sta. Rpt. 1929, pp. 33, 39).—It cost \$2.95 per head for feed to winter 44 pregnant ewes, using a mixture of alfalfa and crabgrass hay as roughage and a mixture of 2 parts of oats and 1 part of bran as concentrates. On this ration the ewes made a slight gain and produced thrifty lambs averaging 7.5 lbs. at birth.

[Experiments with swine at the South Carolina Station] (*South Carolina Sta. Rpt. 1929, pp. 37, 38, 103, fig. 1*).—Brief results of experiments, in continuation of those previously noted (*E. S. R., 60, p. 765*), are reported.

Grain rations for hogs on soybeans.—Pigs receiving a full feeding of corn and tankage made the most rapid and economical gains while grazing soybeans in the green stages and the most rapid gains during the entire period on green and mature beans, but the limited feeding of corn produced the most economical gains for the entire test. An acre of green beans had an average feed-saving value of \$31.95, while an acre of mature beans saved \$25.80. The greatest feed-saving value of beans was obtained when the pigs were full-fed corn.

Protein supplements for fattening hogs.—Pigs hand-fed a combination of fish meal and soybean meal as a protein supplement made an average daily gain of 1.81 lbs. per head at a feed cost of \$7.42 per 100 lbs. of gain, while a combination of fish meal and cottonseed meal fed in the same manner produced a gain of 1.76 lbs. per head at a cost of \$7.71 per 100 lbs. When the cottonseed meal combination was self-fed free-choice, faster and more economical gains were obtained than with the soybean meal mixture.

Hand-feeding v. free-choice feeding of corn and fish meal.—In a comparison of hand- and free-choice feeding of corn and fish meal in dry lot and on forage, the most rapid and economical gains were obtained by the use of the free-choice method. Forage increased the daily gains per head from 1.56 to 1.75 lbs., and reduced the cost of 100 lbs. of gain from \$7.83 to \$7.09.

Hogging off corn.—At the Pee Dee Substation hogs weighing 4,840 lbs. were turned on corn and soybean fields, consisting of 5 2-acre plats, on October 3. The corn was all consumed by November 28, when the hogs weighed 10,258 lbs. It was estimated that the pigs ate 350 bu. of corn and in addition consumed 1,800 lbs. of tankage.

Forage crops for growing and fattening pigs. W. L. ROBISON (*Ohio Sta. Bimo. Bul. 142 (1930), pp. 14-17, figs. 2*).—In order to determine the value of different forage crops for hogs, 6 lots of 8 pigs each, averaging approximately 62 lbs. per head, were fed a limited amount of corn, tankage, and salt for 6 weeks, and the amount was then increased to a full feed of grain. The forages used in the study were soybeans, Sudan grass, Peruvian alfalfa, white sweetclover, alfalfa, and dwarf Essex rape.

The average daily gains during the 112-day feeding period were 1.32, 1.15, 1.23, 1.19, 1.31, and 1.32 lbs. per head in the respective lots. Alfalfa produced the cheapest gains, but the gains on rape were but little higher. Soybeans and Peruvian alfalfa produced gains at the same cost per 100 lbs., but this cost was about 5 per cent more than in the rape lot, while the cost in the Sudan grass and sweetclover lots was about 9 per cent higher than in the rape lot.

Cottonseed meal for maintaining, growing, and fattening hogs (*Texas Sta. Rpt. 1928, p. 78*).—Continuing this study (*E. S. R., 59, p. 768*), the results indicate that not more than 9 per cent of cottonseed meal should be included in the ration of growing and fattening swine. Pigs receiving 12 per cent of cottonseed meal were not so thrifty and did not gain so uniformly as those receiving 9 per cent of the meal. Sows receiving a ration containing 9 per cent of cottonseed meal and 4 per cent of tankage were in better condition than sows receiving 15 per cent of cottonseed meal and no tankage, and the pigs of the former grew more uniformly and made faster gains. The results of 4 years' work have shown that when more than 12 per cent of cottonseed meal is included in the ration some pigs will die from the so called cottonseed meal poisoning, even when they have access to green pasture.

Value of cottonseed meal as a feed for work horses and mules (*Texas Sta. Rpt. 1928, pp. 35, 36*).—In this study a weaning filly weighing 483 lbs. ate

2 lbs. of cottonseed meal daily for one year, had an excellent appetite during this time, and made good growth and gains. Other experimental animals have been receiving either 1 or 2 lbs. of cottonseed meal per head daily without a single mortality, nor have any become blind or lost their hair, and none of these animals suffered any more from colic or heat than similar animals receiving rations containing no cottonseed meal.

Cottonseed meal for mules (*South Carolina Sta. Rpt. 1929, p. 38*).—There was little difference in the efficiency of a ration of shelled corn and grass hay and a ration of shelled corn, cottonseed meal, and grass hay fed to team mates of 8 teams. On corn alone the loss per mule was 15 lbs. and on cottonseed meal 20 lbs. Considerable variation was shown in the amount of cottonseed meal consumed per mule when 0.75 lb. of meal was used to replace 1.5 lbs. of corn.

[Experiments with poultry at the South Carolina Station] (*South Carolina Sta. Rpt. 1929, pp. 82-84*).—The results of several experiments are noted.

Production costs.—The feed cost per dozen eggs for White Leghorns was 14.1 cts., for Barred Plymouth Rocks 16 cts., and for Rhode Island Reds 17 cts., when a simple mash and grain mixture was used. The average yearly egg production was 184.7, 161, and 154.8 eggs per bird for the respective breeds.

Cottonseed meal v. meat scrap.—Birds receiving meat scrap as a protein supplement laid 126.9 eggs per bird during the year, those receiving equal parts of meat scrap and cottonseed meal plus a mineral mixture 138.3 eggs, and those receiving cottonseed meal plus a mineral mixture 124.4 eggs. The percentage of fertile eggs laid by the birds receiving cottonseed meal alone was practically equal to the other lots, but the hatchability of these eggs was quite low. These results indicate that while cottonseed meal is satisfactory for egg production it is not advisable to use it for the breeding flock.

The growth rate of chicks hatched from eggs laid by birds receiving meat scrap was slightly higher than for those from eggs produced on cottonseed meal feeding. The pullets raised from the meat scrap lot laid at a slightly earlier age than those from the cottonseed meal lot.

Ground barley for laying hens.—The results of one year's comparison of ground barley and ground yellow corn showed that egg production, fertility, and hatchability were practically the same in both lots.

Preservation of eggs.—Eggs dipped in a heated mixture of oil and wax and held at temperatures ranging from 60 to 80° F. kept quite satisfactorily at the lower temperatures. Examination and cooking tests of the eggs showed this method to be more satisfactory than the water glass method.

Cod-liver oil for laying hens.—White Leghorn pullets fed 2 per cent of cod-liver oil produced 119 eggs per bird from November 1 to April 30, while similar pullets fed no oil produced 107.4 eggs. The egg production of Barred Plymouth Rocks during the same period was 111.4 and 106.5 eggs, respectively. The eggs of the Rocks were used for hatching, and it was found that the fertility of the cod-liver oil lot was 91 per cent and of the lot receiving no oil 85.4 per cent. The hatchability for these groups was 61.4 and 41.3 per cent, respectively.

Bone meal for laying hens.—Adding 2 per cent of bone meal to a mash containing 20 per cent of meat scrap increased egg production, but had no appreciable effect upon the fertility or hatchability of the eggs.

[Experiments with poultry at the Texas Station] (*Texas Sta. Rpt. 1928, pp. 83, 84*).—The results of two experiments are briefly noted.

Comparison of various feeds for young chickens.—Coccidiosis broke out in a group of experimental chicks that had been on feed for 4 weeks. All of the chicks that had been receiving milk in their diet made satisfactory gains and

had a low mortality, with the exception of one lot. This lot received chloride of lime dissolved in their drinking water, and the solution was evidently too strong as judged by the mortality and slow growth of the chicks. Another lot on hardware cloth made remarkably good gains. Lots receiving commercial coccidiosis remedies did not do as well as the milk-fed chicks.

Studies of variation in hatching quality of eggs.—The hatchability of eggs from 130 individual hens ranged from 0 to 100 per cent (E. S. R., 59, p. 770), while with 7 different flocks the range was from 37 to 65 per cent of the total eggs set. The average hatch of 29,185 eggs set was 53.8 per cent.

Studies on the effects on the growth of chicks of night feeding with the aid of artificial illumination, A. M. ZARATAN (Philippine Agr., 18 (1929), No. 6, pp. 387-396).—In an effort to determine the value of artificial illumination as an aid in securing more rapid growth in brooding chicks, 5 hatches of chicks were divided into 2 lots each at the Philippine College of Agriculture, and fed the same ration. One lot was fed in the normal manner, and the other lot was given an additional night feeding under artificial illumination at 9 p. m.

The chicks receiving artificial illumination consumed more feed than those fed in the normal way but showed no appreciable difference in weight until after the seventh week of age. At this time the difference in gain became marked and remained so until the end of the 12 weeks of feeding. While the mortality rate was unusually high in all lots, it was significantly higher in the lots fed normally, and the highest percentage mortality occurred during the first 4 weeks. The illuminated chicks developed feathers about 1 week earlier and appeared to be more vigorous than the check lot. Most of the extra feed consumed at the night feeding was grain.

Rickets in chicks.—IV, The effect of heat and exposure to air on the stability of vitamin D, G. F. HEUSER and L. C. NORRIS (*Amer. Jour. Diseases Children*, 38 (1929), No. 3, pp. 481-489, figs. 2).—Continuing this series of studies (E. S. R., 60, p. 470) at the New York Cornell Experiment Station two tests were conducted. In the first test 5 lots of 40 chicks each were fed the same basal ration, to which was added a vitamin D tested cod-liver oil as follows: Lot 1, 0.5 per cent of untreated oil; lot 2, 0.5 per cent of oil that had been oxidized 12 hours; lot 3, 0.5 per cent of oil oxidized 24 hours; lot 4, 0.5 per cent of oil oxidized for 48 hours; and lot 5, no oil. Records were kept of weekly growth of the chicks for a period of 6 weeks, and the appearance of rickets determined only when the chicks showed actual stiffness of gait and lameness. In the second test untreated oil was fed to lots of 50 chicks each at levels of 0.5, 0.4, 0.3, and 0.2 per cent. Another lot received 0.5 per cent of oil oxidized for 12 hours, and still another lot 0.5 per cent of oil oxidized for 24 hours. In this test the feeding period was 8 weeks.

In test 1 the lot receiving untreated oil showed no signs of rickets and developed at a rate in excess of normal. In lot 2, 2.8 per cent of the chicks were lame at 6 weeks, and the final average weight in this lot was 69 gm. less than in lot 1. At 3 weeks 2.5 per cent of the chicks in lot 3 were lame, 60 per cent at 6 weeks, and the average final weight was 58 gm. less than the preceding lot. In lot 4, 7.5 per cent of the chicks were lame at 3 weeks and all at the end of 6 weeks, and the chicks averaged 52 gm. less in weight than those in lot 3. In the control lot 8.3 per cent of the chicks were lame at 3 weeks, 77.8 per cent at 6 weeks, and this lot weighed the same and to outward appearances was identical with lot 4.

In the second test, chicks receiving 0.5 per cent of untreated oil grew at a normal rate, but showed evidence of rickets at 7 weeks of age. Lot 2, 0.4 per cent of oil, showed evidence of lameness at 5 weeks, lot 3, 0.5 per cent of oil oxidized

for 12 hours, lot 4, 0.3 per cent of untreated oil, and lot 5, 0.5 per cent of oil oxidized for 24 hours, showed evidence of lameness at 4 weeks, and lot 6, 0.2 per cent of untreated oil, at 3 weeks. At 8 weeks of age the percentage of rickets in the respective lots was 14.6, 21.3, 28.9, 57.5, 68.1, and the last lot had been discontinued because of the severity of rickets.

These results indicate rather conclusively that vitamin D is not a stable vitamin when heated and exposed to air.

A study of the time factor in egg production, H. ATWOOD (*West Virginia Sta. Bul.* 223 (1929), pp. 11, fig. 1).—This is a more detailed account of work previously noted (E. S. R., 61, p. 668).

Report of the New Jersey egg-laying contests, 1928–29, J. W. GOODMAN (*New Jersey Sta. Hints to Poultrymen*, 18 (1929), No. 2, pp. 4, fig. 1).—A report of the first year of the Passaic County egg-laying contest and the thirteenth year of the Vineland egg-laying contest (E. S. R., 61, p. 367).

DAIRY FARMING—DAIRYING

Farm dairying, J. B. FITCH (*Kansas Sta. Circ.* 148 (1929), pp. 31, figs. 12).—This is a revision of and supersedes Circular 90 (E. S. R., 45, p. 678).

[Experiments with dairy cattle at the Texas Station] (*Texas Sta. Rpt.* 1928, pp. 80, 81).—Two experiments are noted.

Feeding value of cottonseed hulls as a roughage for growing dairy heifers.—Heifers were divided into groups when 3 months old, and fed grain and silage and turned on pasture when available. One lot received cottonseed hulls as the only dry roughage, while the other lot received Bermuda hay. The heifers were kept in the same lot until they freshened. Observations indicated that heifers receiving hulls were not so thrifty or well developed as the other lot. The score of 18 heifers receiving hulls was 66.3 per cent and of 21 heifers receiving hay 73 per cent. The difference is statistically significant, showing that hulls are not suitable as the entire dry roughage part of the ration.

The use of cottonseed meal and hulls as a ration for lactating cows.—Large amounts of cottonseed meal, reaching a maximum of 20 lbs. per day for 28 days, have been fed for about 2 years to dairy cows without producing any apparent harmful effect. For cows in dry lot it is deemed good practice to use some other feed along with cottonseed meal to furnish a considerable part of the protein of the ration.

Studies in mineral nutrition, J. B. LINDSEY and J. G. ARCHIBALD (*Massachusetts Sta. Bul.* 255 (1929), pp. 151–166).—The value of a mixture of dicalcium phosphate and calcium carbonate 4:1 for dairy cows has been the object of this study (E. S. R., 54, p. 571) during the 2-year period 1926–28. The experimental animals were fed a basal ration of first-cut hay, dried apple pomace, salt, a grain mixture, and during the summer months an additional feed of nonleguminous green material in amounts not exceeding 25 lbs. per head daily. One-half of the animals had 8 oz. of the mineral mixture incorporated in their grain ration daily.

All of the animals remained in good condition, but it was noted that the mineral-fed animals made a considerable gain in weight, while the other groups showed little change in this respect. Mineral supplements had little or no effect upon the rate of growth of young animals, upon milk production, or upon the composition of the milk. On the other hand, a low-ash ration did not adversely affect milk production. Reproductive troubles were not serious in either group, but the animals receiving minerals were somewhat more normal in this respect and on the whole produced the better calves. No differences were significant enough to warrant any definite conclusions.

In part 2 of this publication an analysis of the mineral matter of 32 samples of hay, 24 samples of corn silage, and 12 samples of miscellaneous roughages collected in various sections of the State is presented. The relation of the botanical composition of the hay and the number of ears in silage to the ash content are shown. Analyses of mineral matter in miscellaneous cattle feeds obtained in various parts of the State and from different sections of the country are also given.

The relation between the external conformation, the internal anatomy, and the producing ability of dairy cows (*South Carolina Sta. Rpt. 1929, pp. 53, 54*).—Data selected from the 36 items covered in the ante-mortem and the 39 items covered in the post-mortem examination of animals slaughtered at the station are listed, and indicate differences in the conformation and internal anatomy of dairy cattle (*E. S. R., 60, p. 770*).

Variation in the duration of gestation in the goat, S. A. ASDELL (*Jour. Agr. Sci. [England], 19 (1929), No. 2, pp. 382-396, figs. 2*).—This study was based on the Kid Register of the British Goat Society, and included the Anglo-Nubian, Toggenburg, a few Saanen, and English breeds, but the majority were of mixed breeding. A total of 6342 gestation periods were considered, which varied in length from 107 to 200 days. The mode was at 151 days for 801 cases.

Slight breed differences were found to exist in the length of the gestation period. Pregnancies due to spring conceptions were of shorter duration than those due to autumn conceptions. The gestation period was shorter for the younger than for the older animals, but the size of the litter had little or no effect. A comparison was made of the length of gestation of the goat with that of other species of animals.

Factors affecting the yield and quality of milk.—I, **The age of the cow**, R. R. KAY and A. C. McCANDLEISH (*Jour. Agr. Sci. [England], 19 (1929), No. 2, pp. 342-372*).—In a study at the West of Scotland Agricultural College the variations in production due to age, based on the records of 738 Ayrshire cows for 4,380 lactation periods, were determined.

The study shows that milk and butterfat production increases up to about 7 years of age, and then declines. The percentage of fat is higher for 3-year olds than for the older cows, but after 3 years there is little change in fat percentage that is of practical significance until the cows reach advanced age, when a significant decline may occur. At least a part of the increase in production with age is probably due to the growth of the secretory tissue of the udder and to body growth in general, and a part to an improvement in functional activity through use. The tendency for milk to show a slightly lower fat percentage as the cow advances in age is probably due to the fact that fat yield changes in the same direction as the change in milk yield, but at a slower rate. The influence of very advanced age on production was not definitely determined, but it is considered probable that many cows maintain for a long time the production of maturity and then decline slowly. Low fat percentage in heifers is not necessarily to be expected to increase with maturity, but it is probable that increase in production with maturity is more closely associated with high initial production than with persistency. Correction factors for age are given.

The influence of feeding on the composition of milk: Mangels versus dried sugar beet pulp, H. T. CRANFIELD (*Jour. Agr. Sci. [England], 19 (1929), No. 2, pp. 302-310, figs. 2*).—With the object of comparing the values of mangels and dried sugar beet pulp in the winter ration of dairy cows, two experiments were conducted under the direction of the Midland Agricultural and Dairy College, England. Two groups of 10 cows each in the first and 8 cows each in

the second experiment were fed by the reversal method, using the same ration in either test aside from the feeds being compared. Composite samples of the milk from each group were taken at 6 consecutive milkings per week and analyzed for fat and solids-not-fat, while milk production was also recorded.

In this study dried sugar beet pulp produced a larger yield of milk and of milk solids than did mangels. Only small differences were found in the composition of the milk produced during the whole period of feeding each ration. The secretion of milk solids was proportional to the yield of milk.

Influence of ground soybeans on market milk and butter (*South Carolina Sta. Rpt. 1929, pp. 54, 55*).—Up to one-half of the grain mixture, ground Biloxi soybeans had no apparent ill effects upon the physical condition of the cows nor upon the flavor and odor of the milk. Feeding soybeans did not decrease the total milk and fat yields more than would be expected from advance in lactation. However, the "soybean butter" was so soft in most churnings that great care was needed not to overwork it. Analyses showed a low moisture and salt content of the butter and a high fat percentage in the buttermilk. These factors caused a low overrun, and it was supposed that the soft fats did not coalesce well and were carried off in the buttermilk. On the other hand, the churning period of the soybean butter was short, due possibly to the fact that the soft fats coalesced quickly. As the amount of soybeans fed increased, the butter became softer and the percentage of fat in the buttermilk increased. The differences between churnings and the average score of butter from morning and afternoon creams were very small. When ground soybeans made up one-fourth or more of the grain mixture low-score butters with oily flavor and defective bodies resulted. This proportion of ground soybeans depressed the Reichert-Meissl number, and the depression was somewhat greater as the percentage of soybeans in the ration increased.

Fifteenth annual report of the creamery license division, T. H. BINNEY (*Indiana Sta. Circ. 166 (1929), pp. 20, figs. 4*).—This is the annual report of the State creamery license division for the year ended March 31, 1929 (E. S. R., 61, p. 265). Indiana dairy statistics, creamery and glassware inspection, and the examination of testers are discussed. Appended is a list of the licensed manufacturing plants of the State.

VETERINARY MEDICINE

[Report of work in veterinary science at the Texas Station] (*Texas Sta. Rpt. 1928, pp. 9-15*).—In further work by H. Schmidt with loin disease of cattle the results obtained in previous tests (E. S. R., 59, p. 776) have been substantiated. The additional data appear to indicate that bone chewing by cattle on the coastal plains of Texas can be checked by mixtures of raw feeding bone meal and fine salt, but not entirely eliminated. It was found also that the trouble known as "creeps" in cattle did not develop among animals receiving the bone meal, while in a large percentage of the control animals it did develop. The advantage of feeding the bone meal and salt mixtures was found to continue until the animal is at least 3 years old, but whether it will continue thereafter remains to be determined. In the search for a cheaper source of calcium and phosphorus than the raw feeding bone meal, superphosphate fertilizer mixed with cottonseed meal, also dicalcium phosphate fertilizer as well as spent bone black, were tested, the latter having been shown to possess some advantages. During the year it was found that in one case the toxic bone retained its toxicity for more than one year when the toxic bones were exposed to weather conditions for six weeks but not thereafter, and that as small a

quantity as 2 lbs. of this bone consumed by an animal weighing about 875 lbs. was sufficient to bring on an acute attack of loin disease.

Bacterial cultures were made and also studies of the conditions on which the organism produced its toxin with negative results. The toxic material was passed through one cow and from there through 13 subcultures, the last of which again proved to be toxic for a cow. This is considered to be excellent evidence that the toxin is produced by some specific organism that grows under anaerobic conditions, but under which it has not been possible as yet to obtain a pure culture. The same material toxic to cattle was found to be toxic to guinea pigs in small amounts. A toxic culture was obtained from water standing in a pond, from the soil collected from the spot where an animal died from loin disease, and also from some carcasses which did not prove toxic to cows in the amounts of materials used in the test. It is pointed out that since it has been definitely established that loin disease is caused by a toxin liberated by an organism in putrid bones and other carcass material, it is obvious that the removal of bones and carcass material from the range is sound procedure in avoiding the disease.

In work with swellhead of sheep and goats a long-chained streptococcus growing anaerobically was again isolated from one of three goats suffering from the affection (E. S. R., 59, p. 776). Although the other two goats were negative culturally, a long-chained streptococcus was found in smears from the kidney of one together with some bacilli. Inoculation experiments with the streptococcus were inconclusive.

In further work with swamp fever in horses and mules (E. S. R., 59, p. 776) it was found that 10 to 12 intravenous injections of 25 to 40 cc. of a 3 per cent solution of tartar emetic were not effective as a cure.

In work with infectious bovine abortion in which live cultures of the organism were administered as vaccine over a period of 3 years, some protection was obtained and the breeding efficiency did not suffer. During the 3 years that vaccination was practiced in the herd the percentage of abortion was 5.5 against an average of 23.76 during the 10 years immediately preceding.

In work by E. A. Tunnick with stomach worms of sheep and goats the administration of tetrachlorethylene in gelatin capsules of 5 cc. for mature animals and 2.5 cc. for kids proved effective in killing the worms and is a practical means of control, provided the factors responsible for the exceptional ineffective cases can be eliminated or at least materially reduced.

A brief reference is made to the occurrence of anaplasmosis in seven Brown Swiss bulls from South Dakota that were being immunized at the station against Texas fever.

[Work with diseases of livestock at the Sonora, Texas, Substation] (*Texas Sta. Rpt. 1928, pp. 122, 123*).—Reference is made to an unsuccessful attempt to transmit swellhead of sheep and goats from animal to animal by injections of various emulsions of the parenchymatous organs and also of whole blood from goats suffering from the affection which failed.

In work with repellents for flies pine-tar oil with a specific gravity of 1.065 plus enough unused lubricating oil to make the mixture hold well was the most effective.

It was found that the recommended dipping solutions of the lime sulfur and nicotine sulfate are efficient in destroying sheep scab if properly applied.

Both the three species of goat lice and their eggs were found to be killed at a single dipping when the animal is held in the dip for one-half minute and the head thoroughly immersed several times in the following substances: Electric, Ferric, Static, and Thylox brands of sulfur, using 5, 10, 20, and 5

lbs., respectively, to each 100 gal. of water, plus 0.5 oz. of fish-oil soap to the gallon. The same results were also obtained when the animals were dipped in standard arsenical dipping fluid testing 0.22 per cent arsenic trioxide. Cotton-seed oil emulsions will also kill both parasites and eggs, but have the disadvantage of permanently staining the mohair.

The most satisfactory treatment thus far found for sore mouth of kids and lambs consists of a mixture of 4 parts of pine tar and 5 parts of unused lubricating oil, to which 1 or 2 per cent of cresol has been added.

The blood picture and its clinical significance (including tropical diseases): A guidebook on the microscopy of blood, V. SCHILLING, trans. and edited by R. B. H. GRADWOHL (St. Louis, Mo.: C. V. Mosby Co., 1929, 7. and 8. rev. ed., pp. 408, pls. 4, figs. 44).—The first part of this work deals with technic (pp. 21-53); the second part with theory, morphology, and division of the blood picture (pp. 54-237); the third part with fundamental principles for clinical use of the blood picture (pp. 239-289); and the fourth part with selected examples of practical use of hemograms (pp. 291-367). An 11-page list of references and disease and general indexes are included.

[Blood studies], R. B. LITTLE (*Jour. Immunol.*, 17 (1929), No. 5, pp. 377-417).—The several contributions on the subject here presented are as follows: I. Isoagglutinins in the Blood of Cattle (pp. 377-389); II, Irregularities Observed in the Isoagglutination Reaction of the Blood of Bovines (pp. 391-400); III, Inactivation by Heat of the Isoagglutinins in the Blood of Cattle with Reactivation by the Addition of Fresh Cow Serum (pp. 401-410); and IV, The Deterioration of Isoagglutinins in Stored Bovine Serum: The Reactivation of the Agglutinins by the Addition of Normal Cow Serum (pp. 411-417).

From the examination of the blood from 209 cows and 31 bulls it was possible to identify three principal groups.

A chemical and histological investigation in Victoria (Australia) of the blood of cattle and sheep, J. H. NORRIS and W. E. CHAMBERLIN (*Aust. Jour. Expt. Biol. and Med. Sci.*, 6 (1929), No. 4, pp. 285-299, pl. 1).—The results of quantitative examinations made of the blood of sheep and cattle for sugar, calcium, urea, nonprotein nitrogen, uric acid, creatinine, inorganic phosphate, and moisture are presented in tabular form, together with the mean, standard deviation, probable error of the mean, and median of each group of figures. The total red and white cell counts, with the differential count, were also made, and a description is given of the leucocytes found in the animals.

The standardization of disinfectants, F. W. TANNER and G. I. WALLACE (*Zentbl. Bakt. [etc.]*, 1. Abt., Orig., 114 (1929), No. 3, pp. 161-174).—This is a digest of the literature, in which a list of 43 titles is included.

A practicum of bacteriology, K. KISSKALT (*Praktikum der Bakteriologie*, Jena: Gustav Fischer, 1928, 5. ed., rev. and enl., pp. VIII+149, figs. 59).—This is a new revised and enlarged edition of the first part of this work (E. S. R., 46, p. 78), of which the second part, by M. Hartmann, has been noted (E. S. R., 62, p. 447).

Endemic infection of guinea-pigs with *B. aertrycke* (Mutton), J. W. EMMERTON (*Jour. Compar. Path. and Ther.*, 42 (1929), No. 4, pp. 258-268).—An endemic due to *Bacillus aertrycke* was investigated, and the causal organism and the pathological lesions which it produces in guinea pigs were studied.

Maternally transmitted immunity to *Bacillus sordellii*, I. C. HALL (*Soc. Expt. Biol. and Med. Proc.*, 26 (1929), No. 9, pp. 799-801).—This is a further contribution on the subject (E. S. R., 62, p. 261), the results of which clearly indicate that immunity to *B. sordellii* (*Clostridium oedematoides*) may be transmitted from female rabbits to their offspring, but whether by placental transmission or by lactation has not been determined.

The resistance of the virus of foot-and-mouth disease to the rays of the quartz lamp, sunlight, and Sollux lamp, and the effect of irradiation upon the course of the disease in guinea pigs [trans. title], K. TRAUTWEIN (*Arch. Wiss. u. Prakt. Tierheilk.*, 60 (1929), No. 2, pp. 101-110; *abs. in Trop. Vet. Bul.*, 17 (1929), No. 4, p. 133).—The author found the rate of destruction of the virus of foot-and-mouth disease under ultra-violet light to depend upon the concentration of the virus in the substratum. Lymph virus in a 1 in 50 dilution or dried was destroyed in from 5 to 60 minutes, but either concentrated guinea pig lymph or epithelial shreds from guinea pig lesions was still infective in most cases after an exposure of 60 minutes. Exposure to sunlight during August proved fatal to the virus after an exposure of 2.5 hours. The small Sollux or incandescent lamp at a temperature of from 34 to 40° C. killed the virus exceptionally in from 1 to 2 hours. Irradiation was apparently without effect upon the course of the disease in guinea pigs.

Diseases transmitted from animals to man, T. G. HULL (*Springfield, Ill.: Charles C. Thomas, 1930*, pp. X+[13]+350, figs. 29).—Section 1 of this work deals with diseases of domestic animals and birds (pp. 1-187), section 2 with rodent affections (pp. 189-243), section 3 with human diseases spread by animals (pp. 245-271), section 4 with animals as passive carriers of disease organisms (pp. 273-289), and section 5 with a review of the rôle played by each animal in the spread of disease (pp. 291-303). The introduction is by V. A. Moore.

Experimental infection of *Brucella abortus* in man.—Preliminary report, P. MORALES OTERO (*Porto Rico Jour. Pub. Health and Trop. Med.*, 5 (1929), No. 2, pp. 144-157, pls. 2).—But one of five normal persons fed different strains of *B. abortus* in pasteurized milk and closely observed developed symptoms and signs similar to undulant fever. This case was fed two cultures of the porcine strain or species. The experiment was repeated in two more cases by feeding repeated cultures of bovine and porcine strains until the organism could be isolated from the feces. Only the case fed the porcine strain developed symptoms of undulant fever. Blood cultures of both cases that developed the disease were positive, one on the fifth and the other on the seventh day of the disease. All other cases have had negative blood cultures.

Undulant fever in man and abortion disease in cattle, E. T. HALLMAN and E. L. ANTHONY (*Michigan Sta. Circ.* 128 (1929), pp. 4).—This practical account, intended for the consumer and producer of milk and the breeder of cattle, discusses the probable animal carriers, apparent low susceptibility of man to infection from milk, evidence indicating the disease to be an occupational one, economic importance of the disease in dairy herds, and steps that Michigan dairymen should take in combating it.

Control of the abortion disease, C. P. FITCH (*Vet. Alumni Quart. [Ohio State Univ.]*, 17 (1929), No. 3, pp. 119-127).—A discussion of the problem, particularly as applied to Minnesota conditions.

Studies of bovine mastitis.—I, The bacteriology of mastitis, F. C. MINETT, A. W. STABLEFOOTH, and S. J. EDWARDS (*Jour. Compar. Path. and Ther.*, 42 (1929), No. 4, pp. 213-231).—The authors report upon bacterial types associated with 113 cases of mastitis under the headings of streptococci, staphylococci, *Bacillus pyogenes*, coliform bacteria, and *B. necrosis*.

Bovine bacillary hemoglobinuria, A. G. BOYD (*Calif. Dept. Agr. Mo. Bul.* 18 (1929), No. 10, pp. 534-538).—The author records the occurrence of this disease in San Diego County, Calif., where his bacteriological findings have been similar to those recorded by Vawter and Records in Nevada (*El. S. R.*, 54, p. 677).

Black (braxy-like) disease of sheep in Victoria, A. W. TURNER (*Jour. Council Sci. and Indus. Research [Aust.]*, 2 (1929), No. 4, pp. 205-208).—The author reports that in work at the Pasteur Institute in Paris he was able to identify the causal organism of black disease in Victoria, and to show for the first time that, in spite of certain minor departures from the type cultures of Europe, it was really a race of *Bacillus oedematiens*. In the work on the causal organism, which is still in progress, only material from cases that have died while under observation or been killed was used, and the post-mortems were made immediately. While the organisms isolated were of the same type as that studied at the Pasteur Institute, the author occasionally met with more than one species.

In vaccination work nearly 8,000 sheep were treated with absolutely no bad results. In every case only half of the sheep on any given property were vaccinated, so that adequate controls might be kept. For the purposes of the first year's trial the vaccine was made from one strain of *B. oedematiens* only, with two injections at a month's interval, in a few cases three being given. The results of vaccination are said to have been excellent on the property from which the strain was derived, three injections having totally checked the disease, while two injections reduced it by 75 per cent. On other properties the results have often been very satisfactory, but not to so high a degree.

It is pointed out that better results may be expected by making the vaccine polyvalent through combining several strains in it.

Caseous lymphadenitis, I, II (*Jour. Council Sci. and Indus. Research [Aust.]*, 2 (1929), No. 4, pp. 209-218, fig. 1; also in *Aust. Vet. Jour.*, 5 (1929), No. 4, pp. 150-159).—In the first part of this contribution on caseous lymphadenitis H. A. Woodruff and D. T. Oser report upon an experimental inquiry as to the common modes of natural infection in sheep (pp. 209-213). Taking into consideration the relative freedom from infection of lamb carcasses at abattoirs and the demonstrable ease of infection of lambs by wound inoculation, the authors consider it safe to conclude that wound infection in lambs is not a serious material factor in the prevalence of caseous lymphadenitis in sheep. In the second part Woodruff and T. S. Gregory report upon observations on the age and sex incidence in an infected flock in relation to possible routes of infection (pp. 213-218).

Dermatomycosis of the sheep (lumpy or matted wool) due to *Actinomyces dermatonomus* (n. sp.), L. B. BULL (*Aust. Jour. Expt. Biol. and Med. Sci.*, 6 (1929), No. 4, pp. 301-314, pls. 2).—The author here describes a dermatomycosis due to a new species of *Actinomyces*, *A. dermatonomus*, affecting young merino sheep. Although the disease is rare, and only one or two animals may be attacked, in some flocks it may on occasion affect over 20 per cent of the young animals.

Anaerobic infections in lambs, W. L. STEWART and D. W. HENDERSON (*Jour. Compar. Path. and Ther.*, 42 (1929), No. 4, pp. 241-258).—It is concluded that (1) grass ill in lambs is caused by an organism indistinguishable from *Vibrio septique*; (2) it is sometimes confused with lamb dysentery, louping ill, and "wool ball"; and (3) *Bacillus welchii* types of organism have no etiological significance in grass ill. Dalling's "L. D. bacillus" (*E. S. R.*, 60, p. 179) was isolated from cases of lamb dysentery. With the exception of the acrolein test, the authors confirmed Dalling's differentiation of the L. D. bacillus and *B. welchii*. It was found that the L. D. bacillus ferments raffinose and not sorbite, while *B. welchii* ferments sorbite and not raffinose, these reactions proving constant with the authors' strains.

Hog cholera, H. C. KERNKAMP (*Minn. Univ. Agr. Ext. Spec. Bul.* 126, rev. (1929), pp. 24, figs. 12).—This is a practical account.

Species of the nematode genus *Strongyloides* parasitic in domestic swine, B. SCHWARTZ and J. E. ALICATA (*Jour. Agr. Research* [U. S.], 40 (1930), No. 1, pp. 11-23, figs. 12).—The authors attempt to clear up existing confusion and uncertainty with reference to the specific identity of roundworms of the genus *Strongyloides* parasitic in domestic swine. Two species are recognized, the name *S. suis* being retained for the present for forms with acutely pointed tails; the other, thought to be the form many helminthologists have considered identical with *S. papillosus* of sheep, is regarded as new and described under the name *S. ransomi*. It was found in feeding experiments that *S. papillosus* can develop to fertile maturity in rabbits, while *S. ransomi* is apparently not adapted to this host.

A list is given of 15 references to the literature.

Poultry diseases, their prevention and control, L. D. BUSHNELL and C. A. BRANDLY (*Kansas Sta. Bul.* 247 (1929), pp. 107, figs. 32).—This is a revision of Circular 106, previously noted (E. S. R., 52, p. 484).

The epidemiology of fowl cholera, I-V (*Jour. Expt. Med.*, 51 (1930), No. 2, pp. 219-274, pls. 2, figs. 9).—In this report on experimental studies, part 1, by L. T. Webster, consists of an introduction (pp. 219-223); part 2, by T. P. Hughes, deals with the biological properties of *Pasturella avicida* (pp. 223-235); part 3, by T. P. Hughes and I. W. Pritchett, with the portal of entry of *P. avicida*—reaction of the host (pp. 239-248); and parts 4 and 5, by I. W. Pritchett, F. R. Beaudette, and T. P. Hughes, with field observations of the "spontaneous" disease (pp. 249-258), and further field observations of the spontaneous disease (pp. 259-274).

A simplified agglutination test for pullorum disease, H. BUNYEA, W. J. HALL, and M. DOBBER (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 4, pp. 408-410).—The authors describe a rapid field agglutination test which overcomes some of the objectionable features of other methods, such as the time element, rehandling the fowls, withdrawal of a large blood sample, and the spoilage of blood samples in transit. The test described is said to be similar to that devised in 1910 by C. C. Bass and J. A. Watkins² for diagnosing typhoid infection in humans, and has advantages not possessed by the method worked out by Runnells and his associates (E. S. R., 57, p. 774).

In performing this test a drop of antigen is added to the drop of blood film on the slide and mixed with it either by use of a stirring rod or by rocking the pane of glass. The reaction with infected fowls consists of a clumping or flocculation of the bacteria suspended in the antigen, which takes places in from 5 to 30 seconds, except for an occasional sample which may require one or more minutes to induce an agglutination. In negative cases the uniform turbidity of the blood-antigen mixture remains unchanged. The antigen employed by the authors was made from five strains of *Salmonella pullorum* washed off of plain beef-infusion agar. Ordinary daylight is said to be sufficient for reading the reaction unless the work is carried on in a poorly lighted poultry house, in which case a lighted incandescent bulb underneath the glass facilitates the reading.

If it is desired to carry out the agglutination in the laboratory, the blood is collected by placing four or five individual drops from each fowl on strips of filter paper, the band numbers of the fowls being recorded on the ends of the respective strips. A dried sample representing one drop of blood is trimmed from each strip and then cut into quarters and dropped into a small test tube containing 0.5 cc. of normal saline solution. The sample is permitted to soak for at least 30 minutes, with occasional shaking but no stirring. Five drops

² Arch. Int. Med., 8 (1910), pp. 717-729

of the dissolved sample (representing 0.5 drop of blood) are placed upon a glass plate, at the same time being so distributed as to cover about a $1\frac{1}{2}$ in. circular space. One drop of the antigen is then placed in the center of this area and mixed with the sample by stirring or rocking. In reacting cases the agglutination usually occurs within a fraction of a minute. Negative cases remain uniformly turbid.

An apparatus for delivering a measured amount of antigen in routine testing for carriers of bacillary white diarrhea, F. R. BEAUDETTE (*Poultry Sci.*, 8 (1929), No. 5, pp. 266-270, figs. 2).—The authors here describe and illustrate an apparatus devised at the New Jersey Experiment Stations which has been used in making about 60,000 tests without necessity of changing any of the parts.

On the occurrence of bacillary white diarrhea in young ducks [trans. title], LEECHE (*Tierärztl. Rundschau*, 35 (1929), No. 10, pp. 169, 170).—The author reports upon the loss of young ducks that occurred in two flocks in Low Silesia caused by *Salmonella pullorum*.

A new method of controlling feather mites, L. F. PAYNE (*Jour. Econ. Ent.*, 22 (1929), No. 5, pp. 819, 820).—In this contribution from the Kansas Experiment Station, the author reports having found lard and vaseline when applied to the infested regions of small chicks to be an effective remedy. In preliminary tests pure Black Leaf 40 was painted three different times at intervals of a few days on the roosting poles and supports about 20 minutes before the roosts were occupied by the chickens. Living mites could not be found on succeeding examinations. Similar results were obtained in a second test.

Flagellates from the ruffed grouse, E. E. TYZZER (*Amer. Jour. Hyg.*, 11 (1930), No. 1, pp. 56-72, pls. 3, figs. 2).—In classifying two rather closely related flagellates which occur regularly in the ceca of ruffed grouse, the author has found it necessary to revise the taxonomy of the Zoomastigina. In doing so he has erected a family (Cochlosomidae) and two genera (Cyathosoma and Ptychostoma) and described two new species.

AGRICULTURAL ENGINEERING

Flow of water in drainage channels, C. E. RAMSER (*U. S. Dept. Agr., Tech. Bul.* 129 (1929), pp. 102, pls. 31, figs. 20).—This bulletin is a revision of and supersedes Department Bulletin 832 (E. S. R., 43, p. 478). It reports the results of experiments to determine the roughness coefficient n in Kutter's formula, as applied to open channels, which were conducted in 10 different localities, namely, Lee, Washington, and Bolivar Counties, Miss., western Tennessee, western Iowa, southern North Carolina, eastern Florida, eastern Arkansas, southeastern Missouri, and central Illinois.

The following values of the roughness coefficient n in Kutter's formula are recommended for use in computing the capacity of drainage channels of the conditions described: Large channel in rolling country, with high velocity and sufficient low water flow to prevent rapid growth of vegetation, slick silt lining perimeter, maintenance, 0.025; large channel in rolling country, with sufficient low water flow to prevent rapid growth of vegetation, moderate erosion, maintenance, 0.03; large channel in flat country, with fairly large low water flow, no appreciable erosion, annual clearing, 0.03; small channel in rolling country, with small low water flow, erosion sufficient to cause some irregularities, maintenance, 0.035; small channel in flat country, with insufficient low water flow to prevent rapid growth of vegetation in lower part of channel, annual clearing, 0.035; large channel with high velocity and large low water flow, rapid erosion causing large irregularities, no vegetation 0.035; and small channel in

flat country with very fertile loamy soil conducive to rapid growth of vegetation, very small low water flow or dry in summer, annual clearing, 0.04.

Surface water supply of south Atlantic slope and eastern Gulf of Mexico drainage basins, 1925 (*U. S. Geol. Survey, Water-Supply Paper 602* (1929), pp. IV+107, fig. 1).—This report, prepared in cooperation with the States of Virginia and North Carolina, presents the results of measurements of flow made on streams in the south Atlantic slope and eastern Gulf of Mexico drainage basins during the year ended September 30, 1925.

Geology and ground-water resources of North Dakota, H. E. SIMPSON (*U. S. Geol. Survey, Water-Supply Paper 598* (1929), pp. V+312, pls. 3, figs. 10).—This report, prepared in cooperation with the State Geological Survey of North Dakota, deals with the physiography, climate, water-bearing formations, and artesian water resources of North Dakota, special attention being devoted to its use for public water systems. An article on the Quality of the Waters of North Dakota, by H. B. Riffenburg, is included (pp. 272-307).

Effects of moisture changes on building materials, R. E. STRADLING (*[Gt. Brit.] Dept. Sci. and Indus. Research, Bldg. Research Bul. 3* (1928), pp. IV+22, pls. 4, figs. 9).—An attempt is made to summarize the principal relationships between water and materials for building construction, and to indicate what effects result from the existence of these relationships. Special attention is devoted to recent investigations on certain physical associations not generally recognized. The discussion is based upon the existence of water in building materials in chemical combination, as free water, and as absorbed water.

Small dimension stock: Its seasoning, handling, and manufacture (*Washington: U. S. Dept. Com., Natl. Com. Wood Util., 1929, pp. X+84, figs. 30*).—This report of the subcommittee on small dimension stock of the National Committee on Wood Utilization, prepared by C. C. Bell, summarizes present conditions in the small dimension industry and the best practices of manufacture, seasoning, and handling. A discussion is given also of cost finding and standardization.

Creosote treatment of Douglas fir, J. F. HARKOM (*Canada Dept. Int., Forest Serv. Circ. 26* (1929), pp. 12, figs. 4).—The process and equipment used are described.

Sheathing, nailing, bracing to produce stronger frame buildings, F. P. CARTWRIGHT (*Building Age, 52* (1930), No. 2, pp. 39-41, 86, 94, 96, figs. 11).—In a contribution from the National Lumber Manufacturers' Association information is given on proper practice in sheathing, nailing, and bracing frame structures, it being shown that diagonal sheathing is about 8 times as strong as horizontal sheathing and that the twisting resistance of three nails is no greater than that of two. It is pointed out also that a 1 by 4 in diagonal bracing let into the studs increases the strength 3.5 times and the stiffness from 2.5 to 4 times.

Electrical soil heating [trans. title], W. KIND (*Technik Landw., 10* (1929), No. 12, pp. 285-290, figs. 9).—German practice in the heating of the soil of hotbeds by electricity is described and illustrated.

It has been found that with an outside temperature in the neighborhood of freezing a hotbed will require approximately 1 kw. hour of electricity per 24 hours per square meter of soil for the average run of hotbed crops. The night use of electricity for this purpose has been found to vary from 100 to 150 watts per hour per square meter of soil.

The utilisation of sisal waste for the production of power alcohol, V. A. BECKLEY (*Kenya Colony Dept. Agr. Bul. 6* (1929), pp. 8).—Experiments on the use of sisal waste as a source of power alcohol are briefly reported, which led

to the conclusion that even with low estimated costs of production it is not possible in the main producing area to utilize sisal waste for the production of power alcohol.

Motor vehicles and tractors, P. M. HELDT (*Nyack, N. Y.: Author, 1929, pp. VIII+678, figs. 461*).—This is both a textbook for students and a handbook for engineers. It is especially adapted for research engineers, since it has been the aim wherever possible to trace the relations of the mechanisms analyzed back to the fundamental principles involved. A special feature is a chapter dealing with some of the problems encountered in the design of tractors. Other chapters included are types of vehicle and their general arrangement; friction clutches; some principles of toothed gearing; change-speed gears; propeller shafts and universal joints; the differential gear; bevel-gear-driven rear axles; the worm drive; double reduction axles; front-drive, four-wheel-drive, and six-wheeled vehicles; brakes; front axles; the steering gear; control; frames and their brackets; chassis springs; independent suspensions; road wheels; chassis lubrication; gas-electric drives; the chain drive; fits and tolerances; and methods of rust protection.

Tractor investigations at the Machinery Institute of the Agricultural Academy of Berlin [trans. title], G. FISCHER, B. POLLITZ, and H. MEYER (*Technik. Landw., 10 (1929), Nos. 10, pp. 233-241, figs. 13; 12, pp. 295-302, figs. 18*).—A description is given of the laboratory and field equipment used for tractor testing by the Agricultural Academy of Berlin. The testing procedure is described also, and some of the first results are presented in graphic form. The equipment and procedure used are patterned somewhat after those used in the Nebraska Experiment Station tractor tests. It is recognized, however, that the tractor presents a complexity of problems, and that rational development must be primarily in individual features. To this end provision is made for studying individual tractor features, such as traction, steering, power transmission, and the like.

Plow tests in Oderbruch soil [trans. title], B. VICTOR (*Technik Landw., 10 (1929), No. 10, pp. 249-252, figs. 8*).—Experiments on the plowing of a heavy, fine-grained humus soil, highly plastic when wet and very hard when dry, are reported, this being the first of a series of experiments to develop tillage tools adapted to this widely spread, difficult soil type. It was found that this soil can be plowed best in the manner desired when in a very dry condition by use of a high pulverizing type of moldboard. A large land side is also necessary to take up the heavy side draft and insure smooth travel.

Wear tests of drill shares [trans. title], KLOTH (*Technik Landw., 10 (1929), No. 10, pp. 253-256, figs. 3*).—Wear tests of drill shares of hard chilled gray cast iron, chilled gray cast iron, semisteel, low test gray cast iron, and ordinary cast iron, conducted by the Agricultural Academy of Berlin, are reported.

The hard chilled gray cast iron shares showed the least wear, and in this respect were four times as durable as the ordinary cast iron in normal sandy loam soils. The chilled gray cast iron and the semisteel shares showed slightly more wear than the hard chilled gray cast iron. Apparently the wear of these shares in sandy loam soils was nearly in inverse proportion to their hardness on the Brinell scale.

Seeding action under the time lens [trans. title], H. ZÖDLER (*Technik Landw., 10 (1929), No. 10, pp. 256-258, figs. 2*).—In a contribution from the Farm Machinery Institute of the University of Breslau, a brief description is given of an apparatus for taking magnified motion pictures of the movements of seeds and fertilizers in the seeding attachments of a seed drill to permit intensive study of such movements as a basis for the rational development of the attachments.

Experiments with sieves for potato harvesting machines [trans. title], [K. A.] NEUHAUS (*Technik Landw.*, 10 (1929), No. 10, pp. 242-248, figs. 21).—Experiments conducted by the Imperial Council for Technical Agriculture of Germany with drum, wheel, and plane sieving attachments for potato diggers are reported. The plane sieves were tested with potatoes moving both lengthwise and crosswise, the test soils being humus loam, sandy loam, and light sand.

Angle of inclination was found to influence profoundly the efficiency of the different sieves, having the greatest influence on the wheel types. For the drum types 10° was the minimum permissible inclination, while the sieving efficiency of the plane sieves was increased up to an angle of inclination of 25°. The wheel type sieve was constructed with a vertical axle and with the sieve wheel situated in a horizontal position and inclined at an angle of 12° to the horizontal toward each of the four different quarters of the wheel, thus making five different test positions. The highest efficiency was obtained with the inclination toward the first quarter with reference to the entrance of the potatoes to the wheel, and the lowest efficiency was obtained with a horizontal wheel.

The factors next in importance were speed of revolution of the drum and wheel types and speed of oscillation of the plane types. This factor especially influenced the plane sieves, and limits of from 2.45 to 5.6 oscillations per second were established, beyond which the efficiency was adversely influenced. Increasing the speed of wheel types increased their efficiency, especially of those with inclinations.

In general, the best sieving results were obtained with the wheel type sieves and the second best results with the plane sieves with cross travel. The drum types gave good results with the light sand soils only. However, none of the types were fully successful in separating heavy soil from potatoes, and in only 4 out of 51 trials did any of the sieves completely separate the lighter soils. The use of sieves alone for this operation is considered, therefore, to be a practice of questionable value.

The plane sieves appeared to be the most imperfect mechanically, especially in view of the excessive wear resulting from inadequate lubrication. The drum types could be lubricated more adequately and stood up better, but were easily choked with weeds and potato vines. The wheel sieves appeared to be the most perfect mechanically of the three types.

Hay stackers and their use, L. A. REYNOLDS (U. S. Dept. Agr., *Farmers' Bul.* 1615 (1929), pp. II+22, figs. 26).—This bulletin supersedes Farmers' Bulletin 1009 (E. S. R., 40, p. 788.) It gives information on several different types of hay stackers and their use.

Designs for Kansas farm homes, H. E. WICHES (*Kans. Engin. Expt. Sta. Bul.* 23 (1929), pp. 105, figs. 45).—Data are presented on farmhouse design to meet Kansas conditions. A number of plans are included.

Investigation of heating rooms with direct steam radiators equipped with enclosures and shields, A. C. WILLARD, A. P. KRATZ, M. K. FAHNESTOCK, and S. KONZO (*Ill. Univ., Engin. Expt. Sta. Bul.* 192 (1929), pp. 69, figs. 39).—Studies conducted by the station in cooperation with the National Boiler and Radiator Manufacturers' Association and the Illinois Master Plumbers' Association are reported.

The results indicated that the use of a properly designed radiator inclosure, or shield, results in a gain in heating economy and equally or more satisfactory air temperature conditions in a room, as compared with those obtained with an uninclosed radiator. It was found that a properly designed inclosure, or shield, should offer a minimum of resistance to the flow of air over the radiator

under gravity head, and should protect the wall back of the radiator against the effect of direct radiation from the radiator. It should have the top of the opening in the face of the inclosure as high as possible and should permit free access of air over the lower half of the radiator, especially near the floor.

It appears that the proper location for insulation in an exposed wall is governed by practical considerations of wall construction and the possibility of air leaks into the studding space or other air circulating channels. From the latter viewpoint it is considered advisable to place the insulation as near to the inner surface of the wall as possible.

The maximum rate of cooling for a wall exposed to a constant outdoor temperature was found to occur immediately after the heating was discontinued, and to be very high. In cases where short warming-up periods are desired after a stand-by period, with no heat supplied, it is considered advisable to install both radiation and boiler heating capacity in excess of that required to maintain a given temperature of the air at the breathing level in the rooms of a building.

Heat insulators, E. GRIFFITHS ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Food Invest., Spec. Rpt. 35* (1929), pp. VIII+96, pls. 3, figs. 34).—Investigations are reported on the thermal conductivities of several different types of insulating materials throughout the range of temperature ordinarily met with in cold storage. The methods used are described, and a brief account is given of work relating to the absorption of moisture by such materials, to their inflammability, and to their structural strength.

The conclusion is drawn that the value 0.0001 c. g. s. unit, or 0.29 B. t. u. per square foot per hour per 1 in. thickness for 1° F. difference of temperature between the faces, may be taken as representative of the thermal conductivity of insulating material of good quality. Most of the samples of slab cork of good quality tested showed the conductivity to be a little less than 0.0001 c. g. s. Finely granulated cork after baking to a dark brown color was found to be a decidedly better insulator than the raw material, the difference being of the order of 13 per cent. Coarsely granulated cork was a less good insulator, because it permitted convection currents in the interspaces between the granules. In this connection it was found difficult to distinguish heat transfer by convection from that by conduction.

Cork wool or cork shavings made remarkably good insulators, which had the additional merit of lightness, weighing only 3.3 lbs. per cubic foot. In practice it is necessary, however, to protect this material from moisture. Dry charcoal was found to be a good insulator, but its moisture-absorbing properties were considered to be a serious drawback to its use for cold storage insulation.

Slag wool or silicate cotton showed a conductivity which is dependent to a marked degree upon the density of packing, decreasing with increasing density to a minimum and then increasing with increasing density.

The results obtained with cellular expanded rubber illustrated the advantages of a material made up of an assemblage of minute air cells bounded by membranes. When shredded, this material was decidedly less efficient than when in the sheet form, this being due apparently to the relatively large air spaces between the pieces into which the material was cut up. Of the various timbers studied the light wood commonly called balsa was found to combine efficiency as a heat insulator with some facility for being cut into shape by carpenters' tools. However, it is soft and easily damaged by blows, and a thin covering of harder material is necessary to make it suitable for the construction of doors and the like. The moisture-absorbing capacity of this wood is also high,

Both crude diatomaceous earth and pumice in granular form showed conductivity coefficients of the order of twice that of slab cork, and were found to weigh about 30 lbs. to the cubic foot. Certain varieties of compressed peat, dried and treated, showed a thermal conductivity as low as cork, but the moisture-absorbing capacity of these materials presented a considerable drawback to their use for cold storage insulation.

RURAL ECONOMICS AND SOCIOLOGY

[Investigations in agricultural economics at the South Carolina Station, 1928-29] (*South Carolina Sta. Rpt. 1929, pp. 6-20, 114-116, figs. 10*).—Results not previously noted of investigations are reported as follows:

Farm credit study of the State.—In addition to the results reported for 1926-27 (E. S. R., 58, p. 684), it has been found that about 76 per cent of the farms used short-term credit, the average annual borrowing per farm on short-term cash or merchant credit being \$463. Of the cash credit, 77 per cent was provided by commercial banks, 8 per cent by agricultural credit corporations, and 13 per cent by landlords and other individuals. A clear tendency toward a greater use of cash credit compared with merchant credit was found. The weighted cost of credit from banks was 8.9 per cent, agricultural credit corporations 7.2, landlords 15.5, other individuals 12, and insurance companies 6 per cent. The cost of cash credit differed in different areas and according to the purpose for which used. The cost of merchant credit from general stores averaged 33 per cent, from fertilizer companies 27 per cent, and from landlords to tenants 35 per cent. The losses by merchants on credit extended averaged from 7 to 21 per cent in the different areas studied. A study of 54 credit-using farms in Florence County showed the following to be the chief factors in determining the cost of credit: Percentage of self-sufficiency or the proportion of readily produceable food, feed, and fuel produced on the farm for the farm family, the amount of short-term credit used, net worth of the borrower, percentage of production received from livestock, and the value of all production per crop area.

Farm organization and management in the Pee Dee area.—In the investigation previously noted (E. S. R., 58, p. 684), the following averages were found: Farm income \$1,236, labor income \$359, operator's earnings \$1,048, and returns on capital 64 per cent. A comparison of the farmers with operator's earnings of \$1,500 or more with those with earnings of \$500 or less showed that the former had 23 acres more in cotton, 9 acres more in tobacco, and 14 acres more in corn and grain, and their yields per acre of cotton were 61 lbs. more and of tobacco 193 lbs. more. The best farmers averaged \$1.63 per dollar expended in production as compared with \$1.15 for the poorest farmers.

Farm organization and management in the Piedmont area.—Charts are given showing for the best and poorest farms the average (1927 and 1928) gross expenses, total and by items, and acreage in different crops. The best farms had 50 per cent of their crop land in cotton and the poorest 42 per cent. Survey and account book records indicate that from 50 to 60 per cent of the crop land in cotton is advisable. The best farmers realized about 12 per cent on their investments, while the poorest showed a loss of 1 per cent. The cost per pound of producing cotton increased from 12.5 cts. on the farms averaging from 351 to 450 lbs. per acre to 20.9 cts. on those producing from only 100 to 200 lbs.

Cotton marketing study.—The grade and staple study indicated that of the 1928 South Carolina crop, 63.03 per cent was $\frac{7}{8}$ in. or less and 36.97 per

cent was $1\frac{1}{2}$ in. or longer staple, and that 32.56 per cent was middling grade, 40.87 per cent above middling, and 26.57 per cent below middling. The production of the State in 1928 of staple lengths over $1\frac{1}{2}$ in., except the $1\frac{1}{8}$ to $1\frac{1}{2}$ in. lengths, was 696,655 bales under the consumption of the mills of the State during the year, while the production of the $\frac{7}{8}$ in. and under lengths was 219,207 bales in excess of the consumption of the mills.

The power unit as a factor in production cost.—Studies on 50 acres of corn divided into 4 parts on the Clemson College farms showed that the man hours required per acre with different power units were for one animal 2.5 hours, two or more animals 1.4 hours, tractor 0.28 hour, and combination 1 hour.

[*Rural economics investigations at the Ohio Station*] (*Ohio Sta. Bimo. Bul.* 142 (1930), pp. 24–26, 27, 28, fig. 1).—Results are reported as follows:

The chief source of income to agriculture in Ohio counties for 1927, J. I. Falconer (p. 24).—A map is given showing the leading sources of agricultural income for each county of the State.

Estimated value of home-produced goods consumed by Ohio households, V. R. Wertz (pp. 25, 26).—Annual estimates, 1924–1928, show that the average values per farm of different home-produced foods and fuel consumed by farm households of the State were for poultry and eggs \$71.81, dairy products \$67.71, garden truck \$60.94, meats \$60.52, fruits \$30.48, fuels \$23.24, grains \$5.94, sirup and sorghum \$1.17, and honey 55 cts., total \$322.37.

Tractors reduce demand for horse feed, F. L. Morison (p. 27).—Farm records kept in Greene and Medina Counties show that the average consumption of feed per horse decreased from 2,936 lbs. of grain and 3,772 lbs. of hay in 1920, when only 3 of the 31 farms on which records were kept had tractors, to 2,158 lbs. of grain and 3,083 lbs. of hay in 1924, when 15 of the 32 farms had tractors.

Index numbers of production, prices, and income, J. I. Falconer (p. 28).—The table previously noted (E. S. R., 62, p. 387) is brought down through October, 1929.

Types of farming in Minnesota, L. F. GAREY (*Minnesota Sta. Bul.* 257 (1929), pp. 36, figs. 18).—Included are (1) maps showing types of soil, average annual precipitation, mean temperature, average dates of killing frost in spring and fall, average length of growing season, early transportation facilities, value of land per acre in 1920, percentage of farm land improved in 1920, percentage of tenancy in 1920, percentages in 1924 of crop land occupied by different crops, and livestock units per 100 acres of crops, 1924; and (2) charts and tables showing the relation, 1860–1925, between railroad development and population, land in farms, land in crops, and number of livestock; for census periods, 1850–1925, the percentage of farm land improved, size of farms, and value of land per acre, and for 1879–1924, the percentage of crop land occupied by various crops; by periods, 1867–1924, the average yield of principal crops; and the number and percentage of distribution of livestock, 1880–1925.

The tables, charts, and maps are discussed, and a map is given dividing the State into seven areas representative of different types or systems of farming. The system of farming in each area is described briefly.

An economic study of 239 blueberry farms in Washington and Hancock Counties, Maine, C. H. MERCHANT (*Maine Sta. Bul.* 351 (1929), pp. 45–96, figs. 9).—Records were obtained by the survey method from 239 selected growers of blueberries, who in 1926 grew 9,184.6 acres of blueberries and 3,037.4 acres of other crops. The financial records covered the year ended March 31, 1927. The other data covered different periods. The data regarding amount

and distribution of capital, receipts, expenses, labor income, classes of blueberry land, age and stands of bushes, yields, factors affecting the yield, etc., are tabulated and discussed.

An analysis is made of the costs and returns in the industry, organization of the farms, and the factors affecting labor income. The more important factors affecting labor income were found to be "(1) size of the farm business as measured by the total productive work units both man and horse, acres actually in blueberries, acres of crops other than blueberries, number and class of livestock kept, man equivalent, and average capital invested; (2) farm balance as measured by acres of crops per animal unit, purchased fertilizer per crop acre, receipts from the various individual enterprises, and the distribution of labor throughout the year; (3) production rates for all crops grown and livestock kept; (4) efficiency of labor as measured by productive work and acres of crops per man and work animal and number of the various classes of livestock other than work animals kept per man; and (5) efficiency of capital as measured by percentage of capital in buildings and value of machinery per crop acre."

The cost of raising dairy cows in West Virginia, P. A. EKE (*West Virginia Sta. Bul.* 224 (1929), pp. 12, figs. 5).—This bulletin is based on data regarding 44 herds consisting of purebred stock and 84 herds of grade and native stock in 10 dairy sections of the State. The cost estimates are for the summer of 1925 and the winter of 1926. Tables and charts are included showing the range and distribution for spring and fall calves in purebred and in grade and native herds of net costs per head and feed costs for the first and second years, and the feed costs and costs of raising grade and native heifers in typical dairy sections of the State.

The net cost per head until freshening ranged from approximately \$50 to \$200 for grade and native heifers, the most common costs being from \$90 to \$130 for spring calves and from \$70 to \$110 for fall calves. For purebred heifers the range was from approximately \$70 to \$240, with the most common costs from \$90 to \$150 for spring calves and from \$90 to \$130 for fall calves. From 50 to 60 per cent of the cost was during the first year, and approximately 77 per cent of the cost was for feed, from 11 to 14 per cent for labor, and from 9 to 12 per cent for other costs. The costs for grade and native heifers were lowest in the creamery section of the State and highest in the small city milk and cream sections.

Income from five hundred hens and one thousand pullets, W. F. KNOWLES (*New Jersey Stat. Hints to Poultrymen*, 18 (1929), No. 1, pp. 4).—An analysis of all of the recent available records of poultry farmers in New Jersey in regard to capital invested, monthly and yearly receipts and expenses, and the average income from a flock of 1,500 birds.

Business records for poultry keepers, E. R. JOHNSON and A. R. LEE (*U. S. Dept. Agr., Farmers' Bul.* 1614 (1929), pp. [2]+20).—Forms for various records useful to poultry men are given and discussed, and steps are suggested for analyzing and making use of such records. This publication supersedes the one on poultry accounts previously noted (*E. S. R.*, 52, p. 92).

An estimated gross cash income from the sale of agricultural products from Ohio farms by counties, 1927, R. E. STRASZHEIM and J. I. FALCONER (*Ohio State Univ., Dept. Rural Econ. Mimeogr. Bul.* 22 (1929), pp. [1]+4).—A table is given showing, by counties grouped into 9 type-of-farming areas, the gross cash income from the sale of farm products (total, per acre, and per farm) and the 6 leading sources of income with the percentage each was of the total income.

Relation of farm power and farm organization in central Indiana, O. G. LLOYD and L. G. HOBSON (*Indiana Sta. Bul. 332* (1929), pp. 37, figs. 15).—Farm business and farm power records were secured from 80 farms in Tippecanoe County for each year from 1919 to 1921 and from approximately 100 farms for each year from 1925 to 1927, 50 per cent of the records for each year being from farms using only horses or mules for drawbar power and 50 per cent from farms using both horses and tractors.

In the later period the horse farms averaged 216.9 acres with 165.9 acres in crops, and the tractor farms 234 acres with 181.7 acres in crops. Comparatively small differences were found on the average for the two types of farms in the percentage of farm area in crops, total animal units per 10 acres, receipts per productive animal unit, crop acres per man, productive man work units per man, total animal units per man, and operator's labor income.

On the tractor farms, crop yields were 6.7 per cent higher, 3.4 per cent more of the crop area was in wheat, man labor per acre of crops was 8.8 per cent less than on horse farms, the crop acres per horse were 32.5 as compared with 23.9 on the horse farms, and the drawbar power cost per crop acre was \$4.34 as compared with \$3.65 on the horse farms. In both periods studied the horses displaced per tractor were 2.1. On all farms having 100 acres or less in crops, on an average 65 acres of crops were cared for per man and the power cost was \$5.17 per crop acre, as compared with 116 acres and \$3.29, respectively, on all farms having 221 or more acres of crops. On the tractor farms of the smaller group, 14.7 days' tractor work was done and 0.73 horse displaced, as compared with 32.8 days and 2.41 horses for the larger group.

During the first 3-year period studied the average number of crop acres cared for per man was 72.4 on the horse farms and 82.9 on the tractor farms, as compared with 95.5 and 95.1 acres, respectively, during the second 3-year period. From the first 3-year period to the second 3-year period, the percentage of work done on horse farms with larger size teams increased as follows: Plowing with 5-horse or larger teams from 10 to 26.4 per cent, corn cultivation with 3-horse teams from 19.1 to 20.7 per cent, and corn cultivation with 4-horse teams from 0.9 to 6.9 per cent. The farmers who did their plowing with 5-horse or larger teams handled 30 per cent more acres of crops per man, had 26 per cent more productive man work units per man, and obtained yields 8 per cent higher than did the farmers who did no plowing with 5-horse or larger teams. As shown by the records for 1,912 horses in the period 1925-1927, the average number of hours of work on the home farm was 818.9 and the average net cost per hour 10.2 cts. On the 147 tractor farms, the average number of hours of tractor use on the home farm was 250 and the cost per hour 92.3 cts. The 122 2-bottom tractors averaged 241.1 hours at an average cost of 85 cts. per hour, and the 27 3-bottom tractors 276.3 hours at an average cost of \$1.174.

The efficient use of men and horses on a 360-acre horse farm and of men and power on a 380-acre tractor farm included in the study are analyzed and discussed.

The status of cooperative cotton marketing in Arkansas, B. M. GUN (*Arkansas Sta. Bul. 245* (1929), pp. 44, figs. 3).—This bulletin discusses what has and what has not been accomplished in the cooperative marketing of cotton in Arkansas, special consideration being given to the Arkansas Cotton Growers' Cooperative Association. The attitude of cotton growers and business men toward cooperation, that of the members of the association toward it, the business done by members with the association, deliveries to and sales by the association and their relation to the price trends, costs of operation of the

association by seasons, the financial operations and credit facilities and the new pooling options of the association, and the present situation and outlook for the future of cooperative marketing in general and the Arkansas Cotton Growers' Cooperative Association in particular are dealt with. The text of these options and cooperative marketing agreement is appended.

The discussion of the attitude of farmers toward the association is based upon schedules obtained by visits to 125 members and 89 nonmembers, 101 replies to an abbreviated schedule mailed to the 1927 membership of the association, and interviews with merchants and bankers.

The study was made in cooperation with the U. S. D. A. Bureau of Agricultural Economics.

Some facts concerning the distribution of fruits and vegetables by wholesalers and jobbers in large terminal markets, M. P. RASMUSSEN (*New York Cornell Sta. Bul. 494 (1929), pp. 115, figs. 31*).—This investigation was made with a view to ascertaining the costs of distributing fruits and vegetables in terminal markets and of suggesting means for reducing such costs. A study was made of the records and trade practices of 15 wholesale firms in Pittsburgh, 28 wholesale firms in the New York metropolitan district, and 1 wholesale firm each in Boston, Detroit, and St. Louis, and 37 firms engaged in the jobbing of fruits and vegetables in the New York metropolitan district, special attention being given to the Wallabout, Gansevoort, Harlem, and Newark markets. The gross sales, different items of costs, gross margins, and profits and losses are analyzed and discussed, and comparisons are made between the several firms.

For the 15 Pittsburgh firms in 1924, 91.19 per cent of the amount received from gross sales was paid to country growers or shippers or absorbed in transportation costs. Of the gross margin (gross sales minus amount returned to country growers or shippers or absorbed by transportation charges), 42.43 per cent constituted wages, 17.09 salaries of managers or principals, 4.40 bad debts, and 4.94 per cent net profit. For the 28 wholesale firms in the New York metropolitan district in 1924, 90.46 per cent of the gross sales was paid to country growers or shippers or absorbed by transportation charges. Of the gross margin, 39.11 per cent constituted wages, 11.37 salaries of managers or principals, 7 bad debts, and 1.73 per cent net profit. Firms dealing in such commodities as potatoes, onions, apples, turnips, and cabbage took about a 4 per cent higher gross margin than did those handling highly perishable or packaged goods, the cost of packaging being the chief cause of the increased margin.

The average gross margin taken by the 37 jobbing firms in the New York metropolitan district in 1924 was 12.4 per cent of the gross sales, as compared with 8.2 per cent taken by wholesalers in the same district. Of the gross margin, wages constituted 41.14 per cent, bad debts 2.59 per cent, salaries of managers or principals 17.88 per cent, and net profit 1.53 per cent. The average percentages of gross sales paid to country growers or shippers, including transportation charges, in the Boston, Detroit, and St. Louis markets studied were for Boston, 1924-1927, 95.6 per cent; Detroit, 1922-1926, 89.4 per cent; and St. Louis, 1922-1926, 94.38 per cent.

The methods of reducing costs of distribution suggested are consolidation into larger units, careful analysis of operating costs, closer cooperation with retailers, and the construction of union terminals with direct rail connections.

A business analysis of the Producers Live Stock Commission Association of National Stock Yards, Ill., K. B. GARDNER (*U. S. Dept. Agr. Circ. 86 (1929), pp. 45, figs. 10*)—An analysis is made of the association's internal organization and operation, its relation to its membership, and its selling

policies, with a view of furnishing a basis for an appraisal of its methods of conducting business.

The background, purpose and organization, and the principal results of the association's operation are described. The receipts of livestock, membership relations, sales activities, operating costs, earnings, and savings of the association are discussed. The amended by-laws of the association are included.

Crops and Markets, [December, 1929, and January, 1930] (*U. S. Dept. Agr., Crops and Markets*, 6 (1929), No. 12, pp. 457-520, figs. 2; 7 (1930), No. 1, pp. 32, figs. 2).—Besides the usual tables, graphs, reports, summaries, and notes in both numbers, tables are included in No. 12 showing (1) by States the acreage, yield per acre, production, farm price December 1, and total value on December 1 of the cereal grains, forage crops (including seeds), fruits, vegetables, tobacco, cotton, and cottonseed for the years 1928 and 1929, and for different truck crops for the years 1926-1929; and (2) the monthly farm prices of different cereal crops, forage crops, fruits, potatoes and sweetpotatoes, cotton, and cottonseed for periods of years, usually from 1910 to 1929, inclusive. No. 1 includes tables showing the acreage and farm value of crops by States, 1928 and 1929, and the results of the December 1, 1929, pig survey.

American cooperation (*Washington, D. C.: Amer. Inst. Coop., 1930, pp. XIV + 638*).—This is a collection of papers and discussions comprising the fifth summer session of the American Institute of Cooperation, held at the Louisiana State University, Baton Rouge, La., July 29 to August 8, 1929, as follows:

National policies with respect to the cooperative movement.—Address of Welcome, by A. T. Prescott (pp. 3-5); Response to Address of Welcome, by L. B. Palmer (pp. 5, 6); The American Institute of Cooperation, by C. W. Holman (pp. 7, 8); The Government's Policy toward the Cooperative Movement, by A. M. Hyde (pp. 9-16); The Relation of the Federal Farm Board to the Cooperative Movement, by A. Legge (pp. 17-24); The Problems of the Federal Farm Board, by C. C. Teague (pp. 25, 26); How the Government Can Aid Cooperatives in Developing Domestic and Foreign Outlets for Farm Products, by N. A. Olsen (pp. 26-38); Cooperation between Cooperatives, by T. Butler (pp. 39-41); Problems of National Unity and Representation, by C. W. Holman (pp. 41-49); and Report of the Organization Committee of the National Cooperative Council, by C. O. Moser (pp. 50-60).

Problems and policies of national and regional cooperation.—Present Problems of Cooperative Marketing, by C. O. Moser (pp. 63-71); The Story of Cooperative Cotton Marketing, by B. W. Kilgore (pp. 71-74); Cooperative Marketing of Livestock, by J. D. Harper (pp. 75-85); The Story of Land O'Lakes, by H. Arens (pp. 86-96); and Cooperative Methods of Marketing Rice, by H. L. Brinkley (pp. 97-102).

Local problems and policies of cooperatives.—How to Build a Fluid Milk Cooperative, by D. N. Geyer (pp. 105-111); How to Start a Cooperative Creamery, by P. L. Betts (pp. 111-121); Marketing Eggs Cooperatively, by S. D. Sanders (pp. 122-126); Local Handling of Livestock, by C. C. Mast (pp. 127-131); Local Cooperative Marketing of Fruits and Vegetables, by N. B. Rue (pp. 131-137); Marketing Georgia Watermelons, by D. K. Young (pp. 137-147); Cooperative Marketing in the Rio Grande Valley, by W. E. Paulson (pp. 147-156); Progress of Cooperative Marketing in Louisiana, by H. F. Kapp (pp. 156-163); The New Orleans Market for Southern Farm Products, by B. B. Jones (pp. 163-170); and Southern Perishables, by M. C. Gay (pp. 170-173).

Relation of the extension service and vocational agricultural schools to co-operation.—Assistance which the Extension Service Can Give to the Cooperative

Movement, by C. C. Teague (pp. 177-181); Possibilities and Limitations of Assistance to Cooperative Associations by the Extension Service, by C. W. Warburton (pp. 181-194); What a Good County Agent Can Do with Respect to Cooperatives, by C. C. Burns (pp. 194-201); The Agricultural High School as a Key to Cooperative Development, by T. E. Browne (pp. 202-209); The High School as a Point of Contact for the Cooperators, by R. D. Maltby (pp. 209-222); and The Cooperative Viewpoint, by R. Hood (pp. 223-232).

Programs of the farm organizations.—The Farmers Equity Union Program for Cooperative Marketing, by L. Melton (pp. 235-240); The Program of the Farm Bureau, by M. S. Winder (pp. 241-248); and The Grange Program, by L. J. Taber (pp. 249-254).

Policies regarding public relations.—Relations between Farm Papers and Cooperative Papers, by C. A. Cobb (pp. 257-259); Shall We Make the Cooperative Publication Self-supporting? by O. M. Lowry (pp. 259-265); What Should the Public Know about a Cooperative? by J. W. Cummins (pp. 266-273); Utilization of Radio Broadcasting, by D. O. Thompson (pp. 273-280); and Cooperative Brands and Trademarks, by M. K. Guthrie (pp. 280-286).

Membership relations in cooperative associations.—Local representatives as a Factor in Membership Relations, by J. W. Jones (pp. 289-297); Contacting with Scattered Membership, by W. P. Bullard (pp. 297-300); Selective Community Membership Campaigns, by E. R. Downie (pp. 301-306); Some Social Factors in Membership Relations, by T. B. Manny (pp. 307-333); and Methods of Maintaining Contacts with Members, by V. Elsinger (pp. 334-381).

Policy-making and management.—Policy-making in Cooperatives, by J. S. Hathcock (pp. 385-396); The Director's Part in Management and Policy, by W. L. Hutcheson (pp. 396-401); and Agricultural Cooperatives and Chain Stores, by M. Stevens (pp. 402-436).

Cooperative Purchasing, Processing, and Insurance.—Cooperative Purchasing as Practised by the Eastern States Farmers Exchange, by J. D. Zink (pp. 439-447); Purchasing Activities of the Michigan State Farm Bureau, by C. L. Brody (pp. 447-457); Cooperative Oil Stations, by H. A. Cowden (pp. 457-467); Control of Affiliated Processing Corporations, by F. J. Elliott (pp. 467-476); and Cooperative Insurance, by M. D. Lincoln (pp. 477-484).

Cooperative financing of production and physical facilities.—Assisting Members to Finance Crop Production, by A. H. Stone (pp. 487-490); Financing the Production of Rice, by P. Zimmerman (pp. 491-497); Assisting Livestock Growers to Finance Production, by E. A. Beamer (pp. 498-507); Financing the Ownership of Physical Facilities, by J. E. Wells, jr. (pp. 507-515); Financing Facilities for Handling Grain, by J. J. Knight (pp. 515-535); and Financing Dairy Facilities as a Problem of Management, by H. Hartke (pp. 535-547).

Marketing credit and reserves.—Necessary Changes in Federal Warehouse Act, by R. A. Ward (pp. 551-556); Finance Problems of the National Cheese Producers Federation, by F. A. Corniea (pp. 556-563); Commodity Credit Needs as Applied to Grain, by E. V. Maltby (pp. 564-566); Commodity Credit Needs for Cotton, by S. L. Morley (pp. 567-577); Financing the Marketing of Cotton, by H. Williams (pp. 577-580); Reserve Policies for Cooperatives, by J. E. Wells, jr. (pp. 581-587); and Utilizing Reserves or Borrowed Capital, by A. D. Waldauer (pp. 588-593).

Rural sociological research in the United States, C. J. GALPIN, J. H. KOLB, D. SANDERSON, and C. C. TAYLOR ([Washington, D. C.: Social Sci. Research Council, *Advisory Com. Social and Econ. Research Agr.*, [1928], pp. 114).—This mimeographed monograph, prepared under the direction of the Advisory Committee on Social and Economic Research in Agriculture of the Social Science Research Council, is based upon a survey of 80 studies in progress dur-

ing the year ended June 30, 1927, in 24 colleges of agriculture and State agricultural experiment stations, 6 nonagricultural colleges or universities, and 3 institutes of research located in 25 States, the U. S. Department of Agriculture, the U. S. Bureau of the Census, and the U. S. Children's Bureau.

The scope and field of the research being done is discussed, the 80 projects being classified as follows: Population 16, standard of living 14, farmers' organizations 3, rural institutions 4, social organization 20, youth organization 5, social psychology 6, and miscellaneous 12 projects. The number of projects in land-grant colleges and universities were, respectively, 9, 13, 3, 3, 13, 4, 6, and 5, making a total of 56.

A summary outline of the field of social research in rural life as it may now be envisaged is presented. An analysis is made of the methods in use in the projects, and a suggested outline of the logical steps in rural social research is presented, together with a bibliography on methodology. A table is given showing the departments having administration and supervision of the rural sociology projects in the several colleges and universities, the first officer in administration above the research worker, and any cooperation with other departments or institutions in the work. The academic training of the research workers on the 80 projects and the financing of the studies are also discussed.

A list showing the titles of the 80 projects and the institutions by which undertaken and a bibliography of research studies in rural sociology arranged by States are also included.

Village service agencies, New York, 1925, B. L. MELVIN (*New York Cornell Sta. Bul.* 493 (1929), pp. 117, figs. 50).—"The specific aims of this bulletin are (1) to describe in a statistical way the structure of the villages in New York according to their agencies, institutions, and organizations; and (2) to show how this structure varies, (a) according to the urban or the farming environments, and (b) according to whether the villages are incorporated or unincorporated."

The chief sources of data were the New York State Census and the U. S. Census of Agriculture, 1925, commercial rating books, questionnaires, special reports and correspondence with headquarters of organizations of different types, and county agents. Information was obtained regarding 1,694 of the approximate total of 1,800 villages in the State. The villages were classified as incorporated and unincorporated and as to size into ten groups ranging from 50 to 249 to from 2,250 to 2,499 population, and also as to whether the counties in which they were located were urban, farming, suburban, or mountain. The agencies, institutions, and organizations studied were grouped into nine categories as follows: Communication, economic, educational, socio-educational, religious, professional, social, recreational, and public.

The statistics are presented in three types of tables and by graphs and maps and are discussed and conclusions drawn. One type of table shows the number of agencies of each kind under each category for each ten villages, incorporated and unincorporated, for the State and for each type of county. The second type of table shows the percentage of agencies of various kinds in the villages. The third type gives statistical data dealing with the relationship between population and agencies. The graphs are based on the first type of table, and the maps show the distribution of agencies in the villages.

In the discussion and conclusions, consideration is given to " (1) the characteristics of different classes of villages, the classes being determined by size; (2) the completeness of different-sized villages as service centers for the rural population; (3) how the number of agencies does or does not increase in

accordance with the increase of population for the different classes of villages; and (4) the statistical relationship of village agencies to village population as determined by various conditions, such as incorporation or being unincorporated, and urban, suburban, farming, or mountain environments." The spatial relations of cities, towns, and villages to villages are discussed.

The following findings of the study are outstanding: On the basis of number and kind of economic agencies found in villages, the villages fall into five classes as to size, 50 to 249, 250 to 749, 750 to 1,249, 1,250 to 1,749, and 1,750 to 2,249 population. A close relation was found to exist between the population of villages and the number of economic agencies in them and also between the population and the total number of professional persons found in them. The coefficient of correlation between the population of villages and the religious, educational, or social agencies is low. Villages above 1,250 in population do not appear to be social centers for the farming population. The grange, home bureau, and other local organizations belonging primarily to farmers are found predominantly in villages with population below 500. The villages of the farming counties have distinct characteristics, and the agencies and institutions found in them resemble one another much more than they do in the villages of the urban counties. Organizations designed to take care of the needs of youth and childhood are critically lacking in villages. Incorporated villages are more completely service centers than are unincorporated villages. Individuals adapt themselves to changing conditions much more quickly than do groups.

This study was made in cooperation with the U. S. D. A. Bureau of Agricultural Economics.

The sociology of the family, D. SANDERSON and R. G. FOSTER (*New York Cornell Sta. Mimeogr. Bul. 1* (1929), pp. [2]+74, figs. 2).—Sociology as a science and the sociology of the family are briefly discussed (pp. 2-9). An outline is given (pp. 10-13) setting forth a basis of sociological analysis and research of the family, and expanded (pp. 14-57) to "indicate contributions that have been made which are in this field and suggest additional types of research that are sociological and that would possibly add to the scientific knowledge now available about the family as a group. Special note is made of researches which deal specifically with the farm family, and those which have a bearing on parent education and child training." A bibliography of 565 items, including books, monographs, theses, bulletins, pamphlets, and periodical and magazine articles, is presented in an appendix.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Rural sociological adult education in the United States, C. J. GALPIN, C. E. LIVELY, B. L. HUMMEL, and C. C. ZIMMERMAN ([Washington, D. C.]: *Social Sci. Research Council, Advisory Com. Social and Econ. Research Agr.*, [1929], pp. 87).—This mimeographed monograph, prepared under the direction of the Advisory Committee on Social and Economic Research in Agriculture of the Social Science Research Council, is related to and in part a sequel of the monograph noted on page 682.

The section on rural sociological programs of adult education, by B. L. Hummel (pp. 5-28), deals with extension work in rural sociology, discussing the problems of such work, the functions of the specialist, the planning of a program, the divisions of a program, and the programs now in effect.

The section on sociological research ready for utilization, by C. E. Lively (pp. 29-51), summarizes under the heads of population, organization, and

standards of living the findings of rural sociological research deemed ready for application in an educational program.

The section on rural sociological problems pressing for solution, by C. C. Zimmerman (pp. 52-87), outlines and discusses briefly some of the major problems in rural sociology in need of further research. These problems are divided into two classes (1) those of immediate practical bearing and dealing directly with the forms of local organization of farmers, and (2) those of the functions of farmers in the national social organization and the rôle played by farmers in the proper functioning of a given national culture.

Under the first class the author briefly discusses research into psycho-social factors which condition organization; into relations between communication and the area of organization; into the development of "interest" groups; into the other external factors contributing to determine forms of social organization; into the internal factors which condition a form, a life cycle, and the success or failure of an organization; into the relationships between forms of social organization (or the presence or absence of a given organization) and the development of the personalities of the individuals of the community; into the needs for organization in various districts; and into the cohesion and the differentiation of functions in rural organizations. Under the second class, studies of the outer characteristics of the organization of the farmer class, of the inner or psychological characteristics of the organization of the rural class, and of population characteristics of the farmer class are discussed.

Thirteenth annual report to Congress of the Federal Board for Vocational Education, 1929 (*Fed. Bd. Vocat. Ed. Ann. Rpt., 13 (1929), pp. XI+104, figs. 16*).—This is a continuation of the series of reports previously noted (E. S. R., 62, p. 89).

Principles in making the vocational course of study in agriculture in the high school, T. H. EATON (*Fed. Bd. Vocat. Ed. Bul. 98, rev. (1929), pp. VII+19*).—This is a revision of the bulletin previously noted (E. S. R., 53, p. 397).

FOODS—HUMAN NUTRITION

Utilization and composition of oriental vegetables in Hawaii, H. L. CHUNG and J. C. RIPPEYON (*Hawaii Sta. Bul. 60 (1929), pp. 64, figs. 52*).—Detailed descriptions with botanical names, Chinese and Japanese names and characters, photographic illustrations to scale, and directions for culinary use are given for 34 leafy and stem, 12 fruit and pod, and 14 roots and aquatic vegetables of oriental origin now grown and used in Hawaii. For most of these vegetables proximate and mineral analyses, with calculations of ash alkalinity, are also given.

The leafy vegetables analyzed included Chinese heading and nonheading cabbage and Chinese and common spinach. It is of interest that the nonheading cabbage was considerably higher in its content of calcium and iron than the heading cabbage. Of the two varieties of spinach, the Chinese was much higher in calcium and lower in iron than the common variety. The leaves of the matr'mony vine were conspicuous for their high protein, energy, and mineral values. Of the fruit vegetables, balsam-pear was exceptionally rich in phosphorus and base-forming elements. Soybeans were superior to other pod vegetables in protein, fat, carbohydrates, and phosphorus. The aquatic vegetables, of which the waterchestnut is the best known, were not as high in carbohydrates as most of the starchy roots, but comparatively high in protein and much richer sources of phosphorus than of calcium. Several of the recipes included are of Chinese and Japanese origin.

Composition of some Philippine fruits, vegetables, and forage plants, A. VALENZUELA and P. J. WESTER (*Philippine Jour. Sci.*, 41 (1930), No. 1, pp. 85-102, pls. 22).—Descriptions, photographs, and proximate analyses are given of 6 varieties of bananas from the Philippines and 1 from Guam, and of 18 Philippine fruits, 3 tubers, 3 kinds of seeds, 6 vegetables, and 12 feeding stuffs.

Quality apple butter, L. M. MONTGOMERY (*Ohio Sta. Bimo. Bul.* 142 (1930), pp. 22, 23).—The utilization of undergrade apples for the manufacture of apple butter is recommended, and general directions involving the use of both cider and sugar are given for its manufacture on a small scale.

Milk in the household refrigerator, A. M. PABST (*Ice and Refrig.*, 76 (1929), No. 1, pp. 14, 15).—This study, conducted at the Bureau of Home Economics, U. S. D. A., deals with the changes in bacterial content of milk held in household refrigerators at definite temperatures for definite periods of time, the changes being based on reduction tests and plate cultures according to the standard methods of the American Public Health Association. Tabulated data are given for the rate of increase in bacteria in raw whole milk and pasteurized whole milk in household refrigerators during 24, 48, 72, and 96 hours at temperatures of 40, 45, 50, 55, and 60° F.; similar data for raw whole milk kept at 40° before delivery and in one series placed in the refrigerator immediately after delivery and in another kept for 1.5 hours before being placed in the refrigerator, the temperatures varying by 5° from 35 to 60°; and finally of the influence of temperature in different sections of the same refrigerator on the increase in bacteria in three samples of the same lot of raw milk.

As was to be expected, the bacterial content increased more rapidly with increasing temperature, more rapidly in the raw milk than in the pasteurized, and much more rapidly in the milk which had not been placed in the refrigerator until some time after delivery. A temperature of not over 45° is thought to be the optimum for storage of milk in household refrigerators, although if the milk is held for not more than 24 hours a temperature not exceeding 50° may give satisfactory results.

Feeding the family, M. S. ROSE (*New York: Macmillan Co.*, 1929, 3 ed., pp. XVII+459, pls. 17, fig. 1).—The principal changes which have been made in this revision of this well-known "guidebook to good nutrition" (E. S. R., 52, p. 258) are summarized in the author's preface as follows:

"No radical changes have been necessary in this edition, but every food plan and dietary has been scrutinized with a view to possible improvement without undue increase of cost, and a number of new food plans and dietaries have been added to exemplify more clearly the kind of food selection which will contribute to the health of every person in the family group. To aid in quick estimations of food values, the tables in the appendix have been extensively revised and new foods and new recipes have been added. The tables of 100-calorie portions and of calories in common measures have been combined and arranged alphabetically for readier reference, and the dietary recipes have also been put in more convenient form. The table of vitamin values in foods has been completely revised, and changes in cost have been made where the former figures did not seem as representative as it is possible for such to be, considering the inevitable difference in market conditions in different localities."

Food preservation in our daily life (*Dayton, Ohio: Frigidaire Corp.*, 1929, 2 ed., pp. X+84, pl. 1, figs. 57).—This booklet contains a brief, nontechnical discussion of the causes of food spoilage, early methods of preservation, refrigeration requirements, and the principles of mechanical refrigeration.

The newer knowledge of nutrition, E. V. MCCOLLUM and N. SIMMONDS (*New York: Macmillan Co.*, 1929, 4 ed., rewritten, pp. XII+594, figs. 55).—In

this revision of the volume noted previously (E. S. R., 54, p. 889), chapters have been added on the effects of vitamin B starvation on metabolism, ultra-violet rays in prevention and treatment of rickets, relation between nutrition and fertility, vitamin E, and specific effects of foods in blood regeneration. Minor changes and additions have been made in the other chapters. In place of the comprehensive bibliography of the previous edition a selected bibliography without titles has been substituted.

The science of nutrition simplified, D. D. ROSEWARNE (*St. Louis: C. V. Mosby Co., 1929, pp. VIII+314, figs. 7*).—A not altogether successful attempt to popularize and simplify the science of nutrition.

Practical dietetics with reference to diet in health and disease, A. F. PATTEE (*Mount Vernon, N. Y.: Author, 1929, 17. ed., rewritten, pp. XIX+856, figs. 10*).—A revision of this well-known handbook, earlier editions of which have been noted previously (E. S. R., 56, p. 895).

Pattee's teacher's dietetic guide (*Mount Vernon, N. Y.: A. F. Pattee, 1929, pp. IV+156*).—This contains the outline for the standard course for student dietitians in hospitals adopted by the American Dietetic Association in 1927, the latest standard curriculum prepared by the committee of education of the National League of Nursing Education for schools of nursing, and the State board requirements in dietetics, together with specimen examinations from the various States.

Foods of the foreign-born in relation to health, B. M. WOOD (*Boston: M. Barrows & Co., 1929, 2 ed., pp. IX+110*).—This is the second edition of a small volume in which brief accounts are given for several race groups of the conditions and dietary habits of the people in their own country and their food problems on coming to this country. Recipes for some of the typical foods of the different nationalities included are given in order to show what simple adaptations can be made by nurses and dietitians to meet specific needs without altering appreciably the characteristic national dishes.

Physical measures of growth and nutrition, R. FRANZEN (*New York: Amer. Child Health Assoc., 1929, pp. XII+138, pl. 1, figs. 4*).—This monograph is devoted to an analysis from the standpoint of growth, development, and nutrition of the anthropometrical data obtained chiefly from field measurements made under the auspices of the American Child Health Association upon about 7,500 public school children of the fifth and sixth grades in 70 schools located in over 38 States.

The conclusion is reached that the main emphasis in judgments made by physicians concerning nutritional status is on weight and muscle size when allowance has been made for skeletal dimensions. Attempts to correlate weight with various other measurements showed that the correlation of height with weight was not nearly as high as that of other skeletal combinations with weight. The method which is thought to measure nutritional status most accurately, at least for the ages represented in this study, is the "actual amount of subcutaneous tissue over the biceps minus the amount of subcutaneous tissue over the biceps to be expected from height, chest dimensions, width of hips, and bisacromial width."

The technic to be followed in obtaining these measurements, the necessary formulas for calculation, and the statistical technic involved are included in appendices.

Basal metabolic rate and surface area of children, D. A. COLLINS (*Soc. Expt. Biol. and Med. Proc., 27 (1929), No. 2, p. 128*).—In this preliminary report data are given on the basal metabolism determined with the Benedict-Collins apparatus of six children, varying in age from 3 years and 3.5 months to 5

years and 2 months, in the Institute of Child Welfare of the University of Minnesota. Inasmuch as surface area measurements have been made on the same children the figures are thought to be of special value as standards.

Overcoming food dislikes: A study with evaporated milk, M. HOLLINGER and L. J. ROBERTS (*Jour. Home Econ.*, 21 (1929), No. 12, pp. 923-932).—This study is of particular interest from the standpoint of the psychology of overcoming food dislikes. The original plan was to determine the first reaction of a large number of individuals of varying ages to diluted evaporated milk as a beverage and then to select certain groups whose reactions were unfavorable for experiments on changing attitudes. In the first phase of the study diluted evaporated milk (5 parts of water to 4 of milk) was offered to 14 groups comprising 921 individuals ranging in age from 9 months to adulthood. Of the total number, 548, or 59.5 per cent. accepted the milk willingly on first trial. Grouped by age, the willingness to drink the milk decreased with age. Of the entire number of children of nursery school age 84 per cent, of those in the elementary and high schools 53 per cent, and of university women about 48 per cent drank it willingly. Among the younger children unfavorable comments of other children or the attitude of the adults serving the milk appeared to be the factor influencing the first dislike to the milk.

The principles governing the attempts to change the attitude of those having an aversion to the food were repeated tasting, following the establishment of the right mental attitude including an appreciation of the value of the food and a real desire to like it, group influence, and attractiveness of the food. In a group of 82 adults, 19 liked the milk on first tasting, 23 were indifferent, and 40 disliked it. After 4 weeks of drinking the milk daily 4 days a week with a definite desire to overcome the dislike, 13 of the 23 at first indifferent to it changed to actual liking, 4 could drink it more readily, 4 continued to be indifferent, and 2 disliked it even more than at first. Of 40 originally disliking it, 15 changed to liking and the remaining 25 changed their attitude somewhat but not to the point of liking the milk.

The effect of roughage upon growth, C. M. McCAY (*Soc. Expt. Biol. and Med. Proc.*, 27 (1929), No. 3, pp. 209-211, figs. 2).—Average growth curves are given of 10 male rats each on rations supposedly adequate in every respect and containing 10 and 20 per cent of cellulose as roughage, and of 5 male and 5 female rats each on diets of high calorie content, with roughage furnished by 20 per cent of cellophane and of agar, respectively. As compared with the growth curves of rats on a satisfactory stock ration, the growth was in each case below normal. Since both sexes showed equal growth on roughage diets, it is considered that females are less affected than males by the presence of roughage. There was no evidence of physical injury except stunting in size.

In a similar series of tests with brook trout, the growth curves of the fish receiving 5, 10, and 20 per cent of cellophane were comparable with those on the stock ration, showing that trout in spite of their short intestinal tract can tolerate large amounts of roughage without any influence upon their rate of growth.

Iron in nutrition.—X, The specificity of copper as a supplement to iron in the cure of nutritional anemia, J. WADDELL, H. STEENBOCK, and E. B. HART (*Jour. Biol. Chem.*, 84 (1929), No. 1, pp. 115-130, figs. 6).—Continuing the investigation noted previously (*E. S. R.*, 62, p. 190), the authors, with the cooperation of E. Van Donk, have tested pure salts of 12 different elements alone and in combination for their ability to supplement a diet of whole milk and iron in the production of hemoglobin in rats. The elements, which included zinc, chromium, germanium, cobalt, nickel, tin, lead, cadmium, mercury, anti-

mony, arsenic, and manganese, were all with the possible exception of arsenic without effect in hemoglobin regeneration, and the effect of arsenic was very slight and temporary. Special attention was given to manganese on account of the favorable supplementing action for iron reported by Titus, Cave, and Hughes. (E. S. R., 61, p. 791) for this element alone or in combination with copper, but negative results were consistently obtained even when a sample of the manganese carbonate which had proved effective in the experiments of Titus and his associates was used.

The results are thought to afford further confirmation of the previous conclusion that the copper is unique in its supplementing action for iron and should be considered a necessary element in animal nutrition. Contamination of iron salts with copper is suggested in explanation of the positive results reported by Beard, Myers, and Shipley for nickel, cobalt, and germanium (E. S. R., 61, p. 590), but the authors are at a loss to explain the findings of Titus and his associates concerning manganese. In regard to the conclusions of Robscheit-Robbins et al. (E. S. R., 60, p. 695) that a group of substances rather than a single substance is responsible for increased hemoglobin production in experimental anemia due to bleeding in dogs, it is suggested that the loss of many substances from the body by hemorrhage may be expected to result in multiple deficiencies quite different from the simple nutritional anemia. It is pointed out, however, that the more favorable effect noted by these workers as resulting from high iron dosage may have been due to small amounts of copper contained in the iron.

The relation of iron and copper to hemoglobin synthesis in the chick, C. A. ELVEHJEM and E. B. HART (*Jour. Biol. Chem.*, 84 (1929), No. 1, pp. 131-141).—A further demonstration of the supplementing action of copper for iron in the regeneration of hemoglobin was afforded by similar results obtained with chicks. Considerable difficulty was at first encountered because normal growth could not be secured in chicks on an exclusive milk diet, and various additions to the milk contained sufficient iron and copper to render the results valueless. The basal diet finally selected consisted of granulated starch supplemented with alcohol- and ether-extracted yeast. On this diet anemia was quickly produced. The addition of purified ferric chloride was without effect until minute amounts of copper were added, which brought about a rapid increase in the hemoglobin content of the blood.

Attention is called to the difficulty in preparing foods other than milk for the production of anemia in experimental animals. It is comparatively easy to reduce the iron content sufficiently, but very difficult to reduce the copper content enough to maintain the anemia when sufficient iron is added. An analysis of the supposedly copper-free synthetic ration with which Drabkin and Waggoner cured severe anemia in rats on a milk diet (E. S. R., 62, p. 190) showed that it contained 0.044 mg. of copper and 0.532 mg. of iron for every 10 gm. of the ration. On the assumption that the rats consumed 10 gm. each of the ration daily they would be ingesting the optimum amounts of iron and copper for hemoglobin regeneration.

The copper metabolism of the rat, C. W. LINDOW, W. H. PETERSON, and H. STEENBOOK (*Jour. Biol. Chem.*, 84 (1929), No. 1, pp. 419-436, figs. 3).—In an effort to throw some light on the metabolism of copper in the animal organism, the authors have investigated the assimilation, storage, transmission to the offspring, and excretion of copper by the rat. The first series of experiments dealt with the determination of the amount of copper stored by two groups of rats at various stages in their development on rations differing only in copper content. The ration itself contained 3.29 mg. of copper per kilogram, and this was supplemented in certain cases by 5 mg. of copper per rat per day adminis-

tered as copper sulfate evaporated on a small amount of the ration. Every precaution was taken to keep the conditions uniform in the two series and to prevent any outside contamination of copper.

The analyses of rats at different ages produced from females fed the unsupplemented stock ration showed a gradual increase in the absolute amount of copper from an average of 0.0108 mg. at birth to 0.4422 mg. at from 210 to 240 days. On a percentage basis there was a constant decrease from birth up to 85 days and a slight increase between 210 and 240 days. In comparison with figures reported for iron by Smythe and Miller (E. S. R., 61, p. 790), the inverse relation between absolute quantity and percentage figures during early life was similar, but there was not the rapid increase in copper after the suckling period as was the case with iron.

The young of the copper-fed rats showed no greater content of copper at birth than the young on the stock ration. There was a very slight increase from the twelfth to the twenty-fifth day attributed to contamination from the mother. At from 75 to 85 days, however, the copper-fed animals contained about twice as much copper and at 210 to 240 days three times as much as the animals on the stock ration. The percentage figures increased continuously after 25 days.

To determine the distribution of the extra copper in the copper-fed rats, 9 adult rats were fed the stock ration plus 5 mg. of copper per rat per day and a control group of 10 the stock ration alone. At the end of 46 days analyses of various organs of both groups showed that the copper feeding had increased the copper content of the skeleton, the kidney, the spleen, and the liver 1.6, 2, 5, and 20 times, respectively.

The blood of the rats on the stock ration contained an average of 0.0543 mg. of copper per 100 cc. and that of rats receiving 5 mg. of copper per rat per day for only 9 days 0.0821 mg. The livers of the latter group were found to contain 0.4234 mg. of copper per rat, or about one-half as much as that stored in 46 days. "This comparison indicates that the retention of copper takes place rapidly but not exclusively during the first few days of copper feeding."

Rats given nothing but milk at the age of 3 weeks had the same copper content at 61 to 76 days of age as when placed on the milk, while others receiving milk supplemented by 1 mg. of copper per rat per day contained at 77 to 83 days almost 4 times as much copper, or about the same amount as those on the stock ration alone. The hemoglobin content of the rats fed milk and copper, while not as low as those on milk alone, was below normal, due to the low iron content of the milk. The young of copper-fed rats, while showing no increased resistance to anemia at birth, were protected somewhat after the twelfth day by ingestion of some of the mother's diet.

Metabolism experiments were conducted on adult rats fed the stock ration with and without copper supplements. The animals on the stock ration excreted two parts of copper in the feces to one part in the urine, while those on the stock ration supplemented with copper excreted about 98 per cent of the copper in the feces. The urine copper increased to about 5 times the quantity present in the pre-copper period. The copper which was stored during the copper feeding period was eliminated during 4 or 5 weeks of post-period feeding.

Some physiological aspects of copper in the organism, F. B. FLINN and J. M. INOUE (*Jour. Biol. Chem.*, 84 (1929), No. 1, pp. 101-114, figs. 2).—In the preliminary discussion of the probable rôle of copper in the organism, attention is called to the property which copper along with some other metals possesses of combining with proteins. In the opinion of the authors much in the human

body is one of the greatest protections against copper poisoning. If food is present in the stomach when copper is fed the copper tends to unite with it, leaving the mucosa of the intestinal tract unaffected. Having combined with the food, the copper is dissolved slowly at a rate depending upon the H-ion concentration.

The paper, like the one by Lindow, Peterson, and Steenbock noted above, reports an investigation of copper metabolism by means of determinations of the distribution of copper in the various organs and in the blood of rats and in the livers and blood of various other species. The method employed for determining copper consisted in ashing the material at a low temperature in an electric oven, dissolving the ash in concentrated nitric acid, evaporating to white fumes after the addition of a few cubic centimeters of concentrated sulfuric acid, dissolving the residue in boiling water, and plating the copper on a platinum cone for about 24 hours with an electric current. The plating process was repeated after the copper had been dissolved from it with a small amount of concentrated nitric acid. The combined copper solutions were evaporated down to about 0.2 cc., made alkaline with ammonia, and the amount of copper estimated from the depth of the blue color. The result was checked by the thiosulfate method with 0.005 N solution of thiosulfate according to the standard procedure for the determination of copper by this method.

A total of 24 rats received copper in their drinking water for 82 days, during which time the total amount of copper placed in the drinking water was 1,203.5 mg. From analyses of feces and urine during the period and of the bodies at the end of the time, the recovery of the copper was estimated to be 1,183.48 mg., distributed as follows: Feces 1,020.78, urine 12.36, bodies 11.34, and deposited in the drinking tubes 144 mg. It is considered that the copper recovered from the feces had been absorbed into the body and then excreted.

The distribution of copper in the body was determined by exposing 10 rats for 12 months to an average dose of 2 mg. of the metal per day in the form of a copper salt dissolved in the water. At the end of the period the rats were killed and the various organs analyzed after removal of the intestinal tracts. The liver proved to be the chief storehouse of the metal, the amount in this organ being 0.25 mg. per gram of dry tissue. The next largest amount was in the brain, 0.21 mg., and the smallest amount in the bones, 0.0046 mg. per gram. The work was repeated with guinea pigs with similar results. Data were also obtained on the copper content of the livers of various animals with no known copper exposure, the amounts varying from 0.23 mg. per 100 gm. of tissue in the cat to 15.6 mg. in the goat. The low content of copper in the bones of the rats is considered of interest in view of the fact that it has been stated in the literature that the bones of copper industrial workers have been found to be high in copper.

Contrary to the results reported by Lindow et al., no additional storage of copper in the liver was found to take place as the result of copper feeding. "We have been unable to find, in any of our experimental animals, an increase in the storage of copper in the liver except in cases where the animals have been fed far larger amounts of copper per kilo of body weight than man would normally be exposed to, even temporarily, in his daily or industrial life."

An examination of the blood of guinea pigs and dogs showed that the oxygen carrying capacity of the blood was increased when copper was being fed to the animals. The hemoglobin content of the blood was considerably increased.

"The results of our experiments indicate that copper may play some important rôle in stimulating blood formation, and that its constant presence in the liver, even in the liver of the fetus, may not be due merely to the fact

that this organ has among its functions that of being a filter. What the combination is in which it is held we can not tell at this stage of our work, but it certainly must exert an important influence on the hematopoietic system and on the metabolism of the body as a whole."

Vitamin work (*Texas Sta. Rpt. 1928, p. 17*).—In this progress report it is stated that yellow corn contains about 3 times as much vitamin A as straw berry corn and about 100 times as much as white corn. Alfalfa meal as placed on the market contained about the same amount of vitamin A as yellow corn. Turnip greens were high in vitamin A. Summer butter was much higher in vitamin A than winter butter.

Reforms in the diet for pregnancy with regard to the vitamin requirements of the fetus [trans. title], E. Voeg (München. Med. Wchnschr., 76 (1929), No. 47, pp. 1959-1961).—This is a discussion, with numerous references to the literature, of the vitamin requirements of the growing fetus and the best methods of providing for these needs. In the opinion of the author the occurrence of premature and stillbirths and the appearance of eclampsia indicate the necessity of initiating vitamin treatment as early as possible during pregnancy. The enrichment of the diet in green vegetables, eggs, milk, and dairy products is recommended, together with in some cases the administration of dried yeast and Vigantol.

The fetus and vitamin A [trans. title], E. Voeg (München. Med. Wchnschr., 76 (1929), No. 42, pp. 1748-1750).—Following the method of Laqueur, Wolff, and Dingemans (E. S. R., 60., p. 195), the author has determined the content of vitamin A in the liver and various other organs of eight human fetuses varying in age from 5 to 9 months. The livers were found to give a strong color test for vitamin A, but no evidence was obtained of the presence of this vitamin in any of the other fetal organs.

Supplying the breast-fed baby with vitamin B, J. H. West (Arch. Ped., 46 (1929), No. 10, pp. 646-650).—The author reviews various studies showing the importance of the vitamin B complex in infant feeding, and explains the method followed in the pediatric department of the Easton, Pa., Hospital for providing a sufficiency of the vitamin to breast-fed infants. This is done in two ways: (1) By furnishing the mother with a diet adequate in the complex and (2) by furnishing some source of the vitamin to the babies themselves. Recommendations for the mother's diet include one raw fruit such as orange, grapefruit, or tomato; two cooked green vegetables; one cooked fruit such as apple sauce, prunes, stewed cherries, or peaches; one raw green vegetable such as lettuce or endive served with olive oil or simple cream dressing; 1 qt. of milk, including what is used in cooking; calves' liver, kidneys, or sweetbreads in place of meat at least once a week; and one tablespoonful of wheat germ sugar (Vitasave) added to the milk or sprinkled on the cereal. The remainder of the diet should consist of palatable foods such as cereals, eggs, meats, vegetables, and simple desserts.

When supplementary feedings are given the child, either wheat germ sugar or dried brewer's yeast is added in amounts of 0.5 to 1.5 oz. of the sugar or 0.5 teaspoonful of the yeast to a 20-oz. formula.

In the experience of the author, many breast-fed babies formerly fretful and irritable, with poor appetite and unsatisfactory growth records, have done well when the mother has subsisted on the vitamin-rich diet, the breast milk increasing not only in quality but also in quantity.

The value of irradiated milk compared with cod-liver oil as a source of vitamin D, K. H. Coward (Lancet [London], 1929, II, No. 21, p. 1090).—Samples of irradiated milk from different sources were found to have an anti-

rachitic activity varying from 0.1 to 2 units per gram as measured by the methods previously described (E. S. R., 59, p. 689). Corresponding samples of untreated milk contained in most cases negligible amounts of vitamin D. As compared with a good quality of cod-liver oil containing 100 units of vitamin D per gram, $\frac{1}{2}$ pint of milk with a potency of 0.2 units is the equivalent in vitamin D content of 80 drops of cod-liver oil, $1\frac{1}{2}$ pints of $\frac{1}{2}$ teaspoonful, and $5\frac{1}{2}$ pints of 2 teaspoonfuls.

Bibliography on cod-liver oil in animal feeding, with noncritical comments and abstracts, J. R. MANNING (U. S. Dept. Com., Bur. Fisheries Doc. 1065 (1929), pp. 333-365).—This document, which is an appendix to the report of the U. S. commissioner of fisheries for 1929, consists of a concise review of the literature on the vitamin content of cod-liver oil, its use in animal feeding in health and disease, and technic of its administration, with dosages for different animals, and an extensive bibliography.

The heat of combustion of ergosterol, isoergosterol, and cholesterol, C. E. BILLS, W. M. COX, Jr., and G. E. STEEL (Jour. Biol. Chem., 84 (1929), No. 2, pp. 655, 656).—In connection with studies on vitamin D, determinations have been made of the heat of combustion of purified samples of ergosterol, isoergosterol, and cholesterol. The mean values obtained were 10,053 calories per gram for ergosterol, 10,050 for isoergosterol, and 10,289 for cholesterol. The slightly higher value for cholesterol is due to the fact that it contains four more hydrogen atoms than ergosterol. These figures show that the molecular structure responsible for the activatability of ergosterol is not associated with an anomalous heat of combustion.

Arginine feeding and creatine-creatinine excretion in man, E. C. HYDE and W. C. ROSE (Jour. Biol. Chem., 84 (1929), No. 2, pp. 535-541).—The conflicting literature on the synthesis of creatine from arginine in the body is reviewed, and a long-continued metabolism experiment on two subjects of similar weight, one male and one female, is reported, the object being to determine whether or not the administration of arginine over a long period of time is followed by an increase in the output of creatine or creatinine. The experiment was continued for six weeks in the case of the male subject and eight in the case of the female subject after the administration of the arginine had been started. The arginine was given in the form of the monochloride to the extent of 1.606 gm., equivalent to 1 gm. of creatine daily.

No increase in the excretion of creatine or creatinine was observed. The results are all the more convincing in that the female subject was the same as in a previous investigation by Rose, Ellis, and Helming (E. S. R., 59, p. 592), in which the daily administration of creatine resulted in a considerable increase in creatinine excretion. It is concluded that "the results offer no evidence in support of the belief that in man exogenous arginine is catabolized to creatine or creatinine."

The formation of glycogen in the liver of the young white rat after the oral administration of glycerol, L. F. CATRON and H. B. LEWIS (Jour. Biol. Chem., 84 (1929), No. 2, pp. 553-559).—The administration of glycerol by stomach tube to young white rats after fasting periods of 24 hours was followed by an increase in the content of glycogen in the liver comparable after 2 or 3 hours to the increase observed after the absorption of glucose over the same period. These results are thought not only to demonstrate the rapid utilization of glycerol in the formation of liver glycogen, but also to suggest a practical use for glycerol as an antidote to insulin intoxication.

Calcification of teeth and bones on rachitic and non-rachitic diets, M. KARSHAN (Soc. Expt. Biol. and Med. Proc., 27 (1929), No. 3, pp. 200-202).—In

this preliminary report, the author states that he has been able to produce only slight variations in the content of calcium, phosphorus, and total ash in the incisor teeth of rats on rachitic diets causing marked changes in the composition of the bones.

Observations suggesting a local factor in pathogenesis in healing of rickets. A. F. HESS, M. WEINSTOCK, H. RIVKIN, and J. GROSS (*Soc. Expt. Biol. and Med. Proc.*, 27 (1929), No. 2, pp. 140-142).—Attention is called to the occasional occurrence of rickets in infants and animals in spite of the fact that the calcium and the phosphorus of the blood have remained at normal levels. An experiment is described in which rickets was brought about in rats by a diet containing a marked excess of calcium (the standard Steenbock rickets-producing ration with yellow corn meal substituted for yellow corn). In some cases the product of $\text{Ca} \times \text{P}$ of the blood was above rather than below normal, but in spite of this rickets persisted and did not yield readily to any of the regular forms of treatment.

The authors conclude that under certain conditions "a local disturbance of the epiphyses may play the determining rôle in the pathogenesis and in the cure of rickets. Under such circumstances, the most potent antirachitic agents fail to exert their usual activity, notwithstanding the fact that the concentration and the ratio of the phosphorus and calcium in the blood are at normal levels."

Rickets in rats.—X, **Fasting tetany and phosphate tetany.** A. T. SHOHL and H. B. BROWN (*Jour. Biol. Chem.*, 84 (1929), No. 2, pp. 501-509).—This continuation of the series of studies noted previously (E. S. R., 60, p. 494) deals with several questions raised by the report of Wilder (E. S. R., 61, p. 495) that fasting induces tetany in rachitic rats and that the increased phosphorus in the blood comes from the destruction of the tissues. Since in the experiments upon which these conclusions were drawn the diagnosis of tetany was made on the basis of convulsions, it was thought advisable to repeat the work, using as the test for tetany the neuromuscular response to the galvanic current (E. S. R., 60, p. 493).

A litter of 10 rats from stock on the Sherman B diet was placed at 30 days on the Steenbock-Black rachitic ration 2965 and 21 days later, after rickets had developed, was divided into five groups of 2 rats each. The first pair was given water only. Another was continued on the diet with added phosphate (NaH_2PO_4) to change the ratio of $\text{Ca}:\text{P}$ from 5 to 2. The third and fourth groups were given a diet with a ratio of 2 on the first day and 1 on the second day, the former with Na_2PO_4 and the latter with H_2PO_4 . The final group was left on the original diet as controls. The electrical reactions were determined on all of the animals at the beginning and after various intervals of time up to 52 hours, after which the animals were killed and the calcium and phosphate of the serum determined by the method of Kuttner and Cohen (E. S. R., 58, p. 510). All the animals except the controls developed tetany, which was especially marked in those receiving the diets with extra phosphorus.

It is concluded that the fasting of rachitic rats results in tetany, and that tetany due to feeding food containing additional phosphate can be demonstrated while the animals are gaining weight. A brief discussion by T. S. Wilder of these findings is appended.

Relation of American dietary to degenerative disease. L. LANGSTROTH (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 21, pp. 1607-1613, figs. 2).—The author has attempted to determine the proportion of protective foods in the diets of over 500 of his patients with various degenerative diseases, and the success

attending the use of a diet containing 70 per cent of protective foods, these including eggs, milk, fresh cooked vegetables, fresh fruits, and lettuce. Although the findings are admittedly qualitative and involve many factors, there appear to be an inverse relationship between the percentage incidence of degenerative disease and the percentage of protective foods in the diet and a decided improvement in or relation from symptoms in cases in which diets high in protective foods were used. A sample corrective diet is given, furnishing 2,147 calories, 70 per cent of which are from protective foods.

Fatty degeneration of the liver and kidneys in the dog apparently associated with diet, W. H. SEBRELL (*Pub. Health Rpts.* [U. S.], 44 (1929), No. 45, pp. 2697-2701).—In the course of the investigation by Goldberger et al. of the blacktongue-preventive action of various foodstuffs (*E. S. R.*, 60, p. 793), some of the dogs which did not develop blacktongue on the experimental diets died suddenly without showing any clearly recognizable signs of illness until shortly before death, when they appeared weak and lethargic and passed rapidly into coma. On autopsy these animals showed marked fatty degeneration of the liver and kidney, sometimes accompanied by fatty degeneration of the heart muscles and an atrophic condition of the spleen. It is thought that the condition is associated in some manner with the diet.

The influence of inorganic elements on blood regeneration in nutritional anemia, V. C. MYERS and H. H. BEARD (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 16, pp. 1210-1213, fig. 1).—This is a more detailed report than the one noted previously (*E. S. R.*, 61, p. 590) of studies leading to the conclusion that a number of elements in addition to copper have an iron-supplementing effect in the treatment of nutritional anemia in rats.

Inorganic elements of spinach in the treatment of nutritional anemia, H. S. MITCHELL and L. MILLER (*Jour. Biol. Chem.*, 85 (1929), No. 1, pp. 355-363, figs. 2).—This is the complete report of an investigation which has been noted from a preliminary report (*E. S. R.*, 62, p. 297). Additional data are given, showing almost as rapid hemoglobin regeneration with an amount of spinach extract furnishing 0.25 mg. of iron as noted in the preliminary report for 0.5 mg. A qualitative analysis of the extract showed the presence in the extract of copper, antimony, tin, iron, aluminum, zinc, manganese, strontium, sodium, potassium, calcium, magnesium, and phosphorus.

TEXTILES AND CLOTHING

Jute ([Ludlow, Mass.]: Ludlow Mfg. Associates, 1928, pp. XIV+112, figs. 77).—An account of the growth and manufacture of jute, discussing production of raw material in Bengal and adjacent districts, marketing the crop, trade practices, commercial handling, and the manufacture of yarn and fabrics from the fiber.

Bibliography on the relation of clothing to health, R. O'BRIEN, E. C. PETERSON, and R. K. WORNER (*U. S. Dept. Agr., Misc. Pub. 62* (1929), pp. 146).—This extensive bibliography on the hygienic aspects of clothing, which has been prepared principally for research workers and teachers of textiles and clothing and for scientific libraries, contains over 1,000 annotated references to English, French, and German books and periodicals. The references are arranged under the headings general, effect of garment style on health, effect of clothing fabrics on health, and clothing as a carrier of disease. A large proportion of the literature covered is not strictly scientific, but is thought to be of value to the research worker as an index of the widespread interest in the hygiene of clothing and as a record of the persistent attempts of both medical profession

and laity to find a more rational basis for modes of dress. The meagerness of the scientific data reported suggests the need for research on textiles and other clothing materials, on individual garments, and on trends in clothing style as they affect the physical condition and comfort of the wearer.

MISCELLANEOUS

Abstracts of papers not included in bulletins, finances, meteorology, index (*Maine Sta. Bul. 349* (1928), pp. [2] + 177-188 + XII).—This contains the organization list of the station; abstracts of six papers, two of which are noted on pages 621 and 644 of this issue, and the remainder previously (*E. S. R.*, 60, pp. 129, 329, 366, 433); meteorological observations, noted on page 610; a financial statement for the fiscal year ended June 30, 1928; an index to Bulletins 343-349, inclusive, which collectively constitute the forty-fourth annual report of the station; and announcements as to the work and publications of the station.

Thirty-seventh Annual Report [of Minnesota Station], 1929, W. C. COFFEY (*Minnesota Sta. Rpt. 1929*, pp. 58).—This contains the organization list, a report of the director on the work and publications of the station, including brief abstracts of articles contributed to outside publications, a list of the station projects, and a financial statement for the fiscal year ended June 30, 1929.

Forty-second Annual Report of the South Carolina Experiment Station, [1929], H. W. BARRE (*South Carolina Sta. Rpt. 1929*, pp. 122, figs. 40).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1929, and a report of the work of the station during the year. The experimental features reported not previously noted are for the most part abstracted elsewhere in this issue.

Forty-first Annual Report [of Texas Station], 1928, A. B. CONNER (*Texas Sta. Rpt. 1928*, pp. 144, fig. 1).—This contains the organization list, a report of the director on the work and publications of the station, and a financial statement for the Federal funds for the fiscal year ended June 30, 1928, and for the various State funds for the fiscal year ended August 31, 1928. The experimental work not previously reported is for the most part abstracted elsewhere in this issue.

The Bimonthly Bulletin, Ohio Agricultural Experiment Station, [January-February, 1930] (*Ohio Sta. Bimo. Bul. 142* (1930), pp. 32, figs. 8).—In addition to 12 articles abstracted elsewhere in this issue, this contains Middlings, "Palmo Midds," and Coconut Meal for Pigs, by W. L. Robison (pp. 17, 18), previously noted (*E. S. R.*, 60, p. 461).

NOTES

California University and Station.—A bequest of \$100,000 made by the late Abraham Rosenberg, a San Francisco fruit merchant, has been announced for the support of graduate research fellowships.

Leave of absence has been granted to the following: Dr. W. P. Kelley, professor of agricultural chemistry and agricultural chemist, effective April 15 to undertake a survey sponsored by the American Society of Agronomy in cooperation with the university as to the present status of nitrogen fertilizer research in the United States and Europe; Dr. W. L. Howard, director of the Davis branch of the College of Agriculture, for six months to be spent in study and travel in Europe, during which time T. F. Tavernetti, assistant to the dean of the College of Agriculture, will serve as acting director at Davis; F. T. Bioletti, head of the division of viticulture and fruit products, in connection with further exploration studies in the Mediterranean region, mainly as related to the horticultural needs of the southwestern United States and in cooperation with the U. S. D. A Bureau of Plant Industry; E. B. Babcock, head of the division of genetics, for four months for travel in foreign countries for the purpose of collecting specimens; and Asher Hobson, professor of agricultural economics in the Giannini Foundation of Agricultural Economics, to enable him to organize and develop a foreign agricultural information service for the U. S. D. A. Bureau of Agricultural Economics and the Federal Farm Board. *Science* announces that E. J. Stirniman, associate professor of agricultural engineering and associate agricultural engineer, is to spend a year as agricultural engineer for the Grain Trust of the Union of Socialistic Soviet Republics, with headquarters at Verblude near the Black Sea. The Grain Trust is said to have about 2,500,000 acres of land in units of from 15 to 20 acres and to be carrying on at Verblude an experimental farm of 110,000 acres.

C. C. Teague of the Federal Farm Board has succeeded Ralph P. Merritt on the board of regents. Emory Voros of the Technical University at Budapest has been appointed research associate in agricultural engineering under the Jeremiah Smith American Fellowship of the Royal Hungarian Ministry of Education. Other appointments include Dr. George M. Peterson, formerly of the U. S. Treasury, as associate professor of agricultural economics and associate agricultural economist in the Giannini Foundation and Dr. James M. Tinley of the Union of South Africa Department of Agriculture as associate in agricultural economics, effective July 1.

Illinois University.—*Science* announces that Dr. F. L. Stevens, professor of plant pathology, is to be the first incumbent of the newly established Baker Memorial professorship in the College of Agriculture, University of the Philippines (E. S. R., 61, p. 500), returning to his regular work in September, 1931.

Iowa College and Station.—Dr. Julius B. Weems, professor of agricultural chemistry and station chemist from 1895 to 1904, died at Ashland, Va., January 25. Dr. Weems was born at Baltimore, Md., August 27, 1865, and was graduated from the Maryland Agricultural College in 1888. After two years of study at Johns Hopkins University, he received the Ph. D. degree from Clark

University in 1894. Since 1915 he had been chief chemist of the Virginia State Department of Agriculture.

Kansas College and Station.—Dr. Roger C. Smith, who has been on leave of absence since August 1, 1928, while serving as assistant director general in the Technical Service of the Department of Agriculture of Haiti, has resumed his work as professor of entomology and entomologist in the station. Dr. C. O. Swanson, head of the department of milling industry, has been granted leave of absence from May 1 to September 30 to make a study of the utilization of American wheat in Europe for the U. S. D. A. Bureau of Agricultural Economics. Dr. E. B. Working, associate professor of milling industry, will serve as acting head of the department during this period.

Maine University.—*School and Society* announces that the board of trustees has authorized the establishment of a school of education. This school will have a separate dean and faculty and will confer the degree of bachelor of science in education.

Massachusetts College and Station.—An addition to the Grinnell Arena, in which laboratory and class instruction will be carried on in meats and meat products, has been erected at a cost of \$14,000. Construction has also been completed for additional greenhouses and laboratory space at the Market Garden Field Station at Waltham to provide for research in floriculture.

Dr. O. C. Boyd, plant pathologist of the Georgia State Board of Entomology, has been appointed extension specialist in plant pathology.

Michigan College.—Plans for a woman's dormitory to cost \$400,000 and to be privately financed under an amortization plan and a bond issue on a self-supporting basis have been approved by the State board of agriculture.

Minnesota University and Station.—At its 1929 session the State legislature appropriated \$20,000 per annum for two years for a land economic survey of the State by the State conservation commission in cooperation with the university department of agriculture. The survey has been organized with the chairmanship divided between the commission and the station, and with the chiefs of the divisions of soils and farm management and agricultural economics as advisers to the chair in outlining the project. The object of the survey is to provide an inventory of the State's natural resources as a basis for future development. A rough classification of the soil is being made, together with a classification of the forest cover, forest growth, industrial development, water power, wild life resources, and recreational possibilities. Work was begun in Hubbard County, as the legislature stipulated that the survey be initiated in the so-called forest area of northern and northeastern Minnesota and that it be completed county by county. It is probable that additional appropriations will be necessary to complete the work.

Considerable interest has also been aroused in the State in the losses occurring from soil erosion. A part of an appropriation by Congress to the U. S. Department of Agriculture for a study of soil erosion, particularly in connection with forest lands, has been allotted to the Lake States Forest Experiment Station for an investigation of soil erosion in the unglaciated region of Minnesota and Wisconsin, and the Lake States station has invited the cooperation of the agricultural experiment stations of the two States in making the investigation. Several field trips have been taken for the purpose of observing the areas where erosion is particularly serious with a view of establishing a soils erosion experiment station. Several areas along the Mississippi River have been located for this purpose, as well as farms where different methods of controlling erosion can be put into effect, and a campaign of publicity has been initiated having for its purpose the awakening of farmers to the danger of both sheet erosion and gulleying.

The station has been giving particular attention to the development of rust resistant varieties of wheat, distributing widely to approved growers last spring a new variety, Marquillo, which has proved rust resistant and has given very satisfactory yields. The milling qualities of this wheat, however, have been questioned by the millers, since it makes a flour with a yellowish cast, although its strength and rising and baking qualities are satisfactory. It has been impossible to determine in the small test mills heretofore available whether or not it can be milled commercially in such a way as to yield a satisfactory flour. Recently an arrangement has been made with the millers whereby a 200-bu. lot will be milled in comparison with a similar lot of Marquis wheat grown in the same localities. It is believed that this amount of flour will be sufficient to enable a decision as to whether or not the color is a serious defect in this promising variety.

Dr. Helen Hart, assistant plant pathologist, has found that the stomata of rust resistant varieties of wheat open later in the morning and close earlier in the afternoon than do the susceptible varieties. As it is in the early morning hours when the dew is on the plants that infection takes place for the most part, it is felt that one key to rust resistance has been found.

A Minnesota State-wide cow testing association was formed recently with Dr. C. H. Eckles, head of the dairy division, as president. This association is preparing to ask the station to do the testing of mail samples sent in by farmers. The details of the plan as worked out include a revolving fund furnished by the association to meet the station expense.

It is announced that Dr. W. E. Petersen, associate professor of dairy husbandry, and Dr. W. L. Boyd, professor of veterinary medicine, who have been studying milk fever, have apparently helped to point the way to a more effective cure for this disease than the standard treatment of udder inflation. On the theory that milk fever might be caused by the low calcium content of the blood, they injected sodium citrate into the jugular veins of six cows. Symptoms resulted strikingly analogous to those of milk fever, including a paralysis extending gradually from the loin forward until there was complete coma. The injection of calcium chloride effected complete recovery and also produced excellent results in cases of natural milk fever. From 60 to 100 cc. from a 20 per cent solution are being injected.

Four herds of the station and its branches are now free from abortion. Two of these are at University Farm, where the beef cattle herd is accredited and the dairy herd is eligible for the approved certificate of the Minnesota Livestock Sanitary Board. The other herds, both approved, are at the Northeast Substation at Duluth and at the North Central Substation at Grand Rapids. The elimination of the disease has in every case been brought about by testing and the use of the board's segregation plan.

Dr. R. N. Chapman, chief of the division of entomology and economic zoology, has resigned to become director of the Hawaiian Pineapple Canners' Association Station at the University of Hawaii vice Dr. A. L. Dean, resigned to engage in commercial work. The appointment becomes effective July 1, and is considered essentially a research position as the business details are cared for largely by an assistant director. The station budget for the ensuing year, supported by a voluntary assessment on the pineapple growers of the island, is said to be \$270,000, with a staff of about 25 specialists.

Missouri University and Station.—On March 18 the newest building in the agricultural group, completed in 1923, was named Mumford Hall, thereby honoring Dr. F. B. Mumford, who has now been connected with the College of Agriculture for 35 years and its dean and director of the station for 21 years.

Nevada Station.—Plans are under way for making a thorough study of an acute disease of the central nervous system of horses which seems to be steadily increasing in prevalence. As the disease attacks primarily work and saddle horses of relatively high unit value, it is of considerable economic importance. Preliminary observation and study over a period of years have shown beyond reasonable doubt that the disease is markedly contagious or infectious, but the causative agent has not yet been determined.

New Mexico College and Station.—An additional well is being drilled, 20 miles more of fence were recently built, and other improvements are being made on the college livestock ranch. Much of the expense involved is defrayed from a \$10,000 appropriation made at the last session of the legislature.

New York State Station.—William T. Tapley, at one time professor of vegetable gardening at the Pennsylvania College, has been appointed associate in research (horticulture) to fill the vacancy occasioned by the death of F. H. Hall, previously noted (*E. S. R.*, 61, p. 900), and has entered upon his duties. His entire time will be given to the vegetable variety testing and the preparation of the monographs on vegetables.

North Dakota College.—Dr. J. H. Shepperd, acting president since the resignation of Dr. J. L. Coulter, has been appointed president.

Pennsylvania College and Station.—The first wing of the new botany building has recently been occupied. This wing is 90 by 60 ft. with 3 stories and basement and is of fireproof construction throughout. It contains 8 large laboratories, 2 classrooms, a reading room, a herbarium room, numerous small rooms, offices, etc.

Washington College and Station.—Neil W. Johnson, instructor in farm management and economics and assistant agricultural economist, has resigned effective June 1 to accept an appointment as associate agricultural economist with the U. S. D. A. Bureau of Agricultural Economics, and has been succeeded by E. F. Landerholm.

New Journals.—*The Journal of Dairy Research* is being published semi-annually for the dairy research committee of the Empire Marketing Board by the Cambridge University Press, Fetter Lane, E. C. 4, London. Its object is to "afford mutual assistance to workers in the Empire in the sphere of dairy science," and it will include monographs by specialists reviewing the existing state of knowledge in different aspects of dairying, original contributions to dairy science by workers within the Empire, and reviews and abstracts of current literature. The initial number contains a monograph, *Feeding Standards for Dairy Cows*, by E. T. Halnan (pp. 3-34); original articles entitled *Studies in Lactation—I, Variations in Some Chemical and Physical Properties of the Milk from Individual Quarters of a Cow*, by E. C. V. Mattick and H. S. Hallett (pp. 35-49), *Rusty Spot in Cheddar and Other Cheese—I, Description of the Causative Organism*, by J. G. Davis and A. T. R. Mattick (pp. 50-57), *Control of Bovine Tuberculosis in Canada*, by G. Hilton (pp. 58-63), and *The Organization of Dairy Research in New Zealand*, by E. Marsden (pp. 64-74); and about 120 abstracts and reviews. *The Journal* is edited by Dr. R. Stenhouse Williams, with Dr. J. H. Grisdale of Canada, Director W. Riddet of New Zealand, Prof. H. B. Davel of South Africa, Dr. Connell Boyle of University College, Cork, and T. Hamilton of Southern Rhodesia, as cooperating oversea correspondents.

The Tasmanian Journal of Agriculture is being issued quarterly by the Tasmanian Department of Agriculture. The initial number contains a brief exposition of the work of the department and several popular articles and seasonal notes.

EXPERIMENT STATION RECORD

VOL. 62

JUNE, 1930

No. 8

Notwithstanding the elaborate development of research systems in a number of countries to-day, the organization of agricultural research upon an institutional basis is a relatively recent undertaking. It was less than 80 years ago that the first experiment station organized as a public institution was established at Möckern and only 8 years earlier that Lawes and Gilbert began their epoch-making studies at Rothamsted. Since those historic days various plans of organization have been devised and several promising ideas have been more or less extensively tested, but it is not surprising that there is still much diversity of opinion and practice. Few would be so bold as to assert that the ideal type had as yet been worked out in any final way, and interest still attaches to ventures not fully conforming to the customary methods.

What appears to be an innovation in some respects has been in operation in India since 1924 under the name of the Institute of Plant Industry at Indore. An account of this enterprise, prepared by its sponsors, Director Albert Howard and Gabrielle L. C. Howard, a botanist of its staff, has recently become available under the title of *The Application of Science to Crop-Production*. This account is not only of significance for what it reveals as to the progress of the institute itself, but as a contribution to the theory of research organization in general.

In India, as in many other regions, reliance for agricultural research has thus far been most exclusively on what may be termed the general-purpose institute, with the usual subdivisions into the separate sciences. This arrangement, we are told, has been found to be, under the special conditions there presented, by no means ideal. "It was soon discovered," the authors state, "that the problems presented in the improvement of a crop can not be split up into a number of parts without grave detriment to the whole. To attempt to do so not only leads to the fragmentation of the problem but also seriously limits that freedom which is so essential to the scientific investigator of economic questions. The center of the subject of crop production must always be the plant itself, which obviously can only be effectively studied in relation to the soil in which it grows, to the conditions of village agriculture under which it is cultivated,

and with reference to the economic uses of the product. . . . The need for the broadening of the subject, as well as for the development of new methods and new lines of attack, became more and more insistent. The only practical solution of the difficulty appeared to lie in making crop production one of the main sections of agricultural research work in India and in abandoning the present fragmentation of the subject altogether. As it is not easy to change any form of organization from within, this involved the foundation of a new institute for crops, at which the development of the plant could be studied as a biological whole and not piecemeal."

Having these views in mind, Director Howard, who had previously been connected with the research institutes at Pusa and at Quetta, became in 1919 agricultural adviser to the States in Central India and Rajputana, a region without an experiment station, and immediately took steps to organize a research institute for crops which would directly embody the ideals referred to above. After some disappointments and delays the plan was approved in 1924, and work was begun late in that year. A tract of 300 acres of land was placed at the disposal of the institute by the Indore Durbar for 99 years at a nominal rental. Eight States in the region contributed a total of 20,800 rupees (\$6,739) for annual maintenance, and by 1929 this support had been increased to 16 contributing States and a total of 44,550 rupees per annum. The principal funds, however, were obtained from the newly-established Indian Central Cotton Committee, which granted 200,000 rupees toward a capital cost of buildings and equipment and has been supplying 100,000 rupees each year for maintenance. From still other sources benefactions aggregating over 100,000 rupees were secured. Thus, the institute was established as the unique combination of public and private, "an example of the union of diverse interests for a common purpose." In the beginning its accounts were handled by governmental agencies, but in 1928 it was incorporated as a distinctive entity with a representative board of governors.

The objects of the institute are set forth as threefold. They include "the investigation of all matters relating to the production and improvement of raw cotton in India," the agricultural development of the contributing territories, and the provision of an agricultural center to serve as an object lesson and to provide for the training of both advanced students and practical cultivators.

The greater part of the interval since the institute began operations has necessarily been devoted to the preliminary development of its holdings. Much of the land was rough, undrained, and inaccessible, and it was not expected that all the fields could be made suitable for experimental work until the present season. Three sets of buildings were erected, a group of laboratories, the farm build-

ings, and a "model village" for a portion of the staff, for visitors, and for certain laborers. Because of the relatively small funds, the laboratory group is of simple construction but contains office, library, and lecture room facilities, as well as a chemical laboratory fitted up especially for work in soil science and a set of botanical laboratories. The farm appliances were designed to employ no power beyond the reach of the average well-to-do cultivator of the region, but the farm buildings embody much specialized construction, including extensive arrangements for composting and a small cotton ginning factory.

As the Indore Institute owes its existence to the grants made by the Central Cotton Committee and was formed primarily for research on cotton, the investigations with this crop are the principal concern of the staff of about 15 scientific workers. Thus far the cotton studies have dealt with basic questions, genetics, and agronomy. Much time has been given to a botanical survey and classifications of the multitudinous types of cotton now found in India. The chromosome numbers of 28 types have been determined, and a preliminary study has been made of the root systems and of the influence of environmental factors on the lint. It has been found that the adaptability of certain types to the local conditions is often closely related to their root systems, the failure of American types like Cambodia as a rains crop on the black soils being attributed directly to this cause, and it is believed that much of the breeding work of the future will deal with the life history of the root system and its relation to the type of soil quite as much as the growth of the shoot and the amount and character of the fiber. The cause of the shortening of the fiber under less favorable environmental conditions is another problem which is regarded as very important if a product of uniform grade is to be maintained.

One of the consequences which the Howards ascribe to "the fragmentation of agricultural problems in the past" is the difficulty of considering in a comprehensive way the influence of adverse soil factors on the susceptibility of the plant to disease, and the reasons why a plant in health remains immune to the attack of certain insects or fungi. "There is a vast literature on some of the fragments of this question, but for the most part it concerns various insects and fungi, is unrelated to the essential soil factors, and has been carried out on much too narrow a basis. The wider aspects of disease and immunity are being taken up at Indore and already progress is being made. Evidence is being obtained that the soil conditions necessary, say for an insect epidemic, must begin to operate some months before the actual insect appears and that the sequence of events is somewhat as follows: Unfavorable soil conditions lead to changes in the acidity and other characters of the sap and so prepare suitable food

for the insect or fungus which thrives just as long as this food supply is available. Favorable soil conditions, on the other hand, bring about a marked increase in the resistance of the plant. Further, insects and fungi do not spread from the susceptible area to the healthy crop alongside. An investigation of the causes of the red leaf of cotton on these lines is being carried out."

Despite the present and potential importance of the cotton crop in India, efforts at improvement thus far have dealt largely with the securing of better varieties, and the agronomic and soil factors involved have received little attention. However, it is pointed out that "improved varieties give some increase in the total yield, but such results are small compared with the enormous increment made possible by better agricultural conditions," and it is believed that "the cotton work of the future must be a well-balanced combination of agronomy and genetics with soil science." For this reason cotton agronomy has been made one of the leading subjects of research at Indore. This phase of the work has recently been aided by a special contribution from a wealthy merchant of India, Sir Sarupchandji Hukamchand, for the maintenance of a scholarship in cotton agronomy open to distinguished graduates in science of the Indian universities.

At least four soil factors have been found to limit seriously the growth and yield of cotton on the black soils of the region. These are the loss of fertility by perennial grasses, the lack of control of run-off during the monsoon rains, insufficient permeability during the second half of the monsoon because of the excessive development of soil colloids, and the low content in these soils of organic matter. All of these factors retard the growth of cotton through a depriving of the plant of nitrogen. The soil colloid problem is regarded as particularly complex, but for the remaining difficulties remedies have already been suggested which it is thought will be readily applicable and effective.

Although one of the outstanding characteristics of the institute is its concentration of effort upon cotton, attention has been given to some supplementary activities as opportunity has permitted. Among these have been an improvement of irrigation practice; the development of substitute crops for the opium poppy, production of which, it is stated, is being given up; the improvement of the work cattle by the better feeding possible with an increased use of silage; and the encouragement of the introduction of suitable improved implements and machines.

Considerable thought has been given to the dissemination of the practical results obtained by the institute. Although primarily a research and not an educational agency, a small number of qualified

students are being accepted for training and return to strategic points in their respective districts. For extension purposes, the institute has arranged a number of cultivators' meetings on its own grounds at which demonstrations and lectures on selected topics have been dealt with at some length. Gratifying results are already reported from many of its contributing constituencies. In the Holkar State, a new department of rural development has been set up, working in very close touch with the institute, and is just opening a farm of its own for the improvement of the Malvi breed of cattle. A new experimental farm is being started by the Maharaja of Bikaner on the new Gang Canal for dealing with the local problems presented in the best use of the available supply of canal water. In Jaipur, a large cattle and demonstration farm is being operated at Basi, and work among the cultivators is in progress. In two of the Central India States, agricultural schools are being opened in connection with new demonstration farms. In all cases where such demonstration farms are being started or work in the villages is being undertaken, the State officers in charge of the work are sent to the institute for a definite period of training, and the advice of the institute is sought before any projects are undertaken. Thus, we are told, "the original idea that the institute would serve as a center of agricultural research and of agricultural information in Central India and Rajputana has already been realized. More and more interest is being taken by the durbars in the work, and more and more advantage is being taken of the results. It is now generally recognized that the institute has become an important research and training center, which exports ideas and information on rural reconstruction as well as improved varieties of crops and new methods of cultivation. It is already acting as a stimulus in general rural development. The States have realized the advantage of possessing an up-to-date experiment station in their midst, so that their resources can be utilized on definite and practical local schemes. In this there is great economy, in time as well as in money. In a single generation it is more than probable that some at least of the contributing States will reconstruct their villages and incidentally double their land revenue."

The concluding chapter of the book deals more or less abstractly with the organization of agricultural research, including such phases as the relation between central and local research stations and the clear differentiation between research and demonstration. On the latter point a strong plea is made for a distinctive line of cleavage. "Two branches—research and demonstration—which are both equally important, should be developed in every agricultural department. The staff in every branch should be carefully selected for the

work they have to perform." "The idea that to be successful every officer working in the districts must attempt something in the way of research must be given up entirely." "The art of demonstration and of inducing cultivators to adopt improvements is as important as that of research, and every endeavor should be made to develop this branch of the subject as a separate and as an honored profession."

"The relation between the Institute of Plant Industry at Indore and its contributors," it is stated, "has been arranged in accordance with this conception. All the research work is carried out at the institute, where ample facilities for scientific investigations and a good library have been provided. The demonstration work is carried out by the contributing States themselves, and it is hoped that in time each State will have a demonstration farm which will serve as a center for local propaganda. Liaison is maintained by . . . the visits of the director to the States, of State officials and agricultural workers to the institute, by cultivators' meetings, and so forth."

As to the larger question of an Empire organization, the policy advocated is definitely that of decentralization. "The ideal system of conducting agricultural research in the Empire," it is declared, "seems to lie in the simplification rather than in the elaboration of the organization. All that is necessary appears to be to provide each region with a research institute of its own, to do everything possible to increase the efficiency of these centers, and to allow the workers every facility for unofficial consultation and discussion, such as is provided by the meetings of the British Association, the Indian Science Congress, and similar bodies. Better men are needed, not more machinery. Any funds that can be provided in the future for agricultural research should be devoted to the payment of competent investigators and to the provision of the means necessary for these men to work out their ideas. In other words, agricultural research must be made a profession. Until this is done, no real progress is possible."

These views are interesting, though put forward in connection with conditions more or less unique and presumably not intended as generalizations for universal adoption. Some of them are in essential accord with the prevailing thought in this country and would find corroboration in its experience. Others would meet with less ready acceptance. Substantially all, however, who have studied the matter will agree that there is much food for thought in the final sentences: "Any attempt to overstrain systems of organization in the hope that they may replace competent investigators can only end in failure. In research, the man is everything; the organization is a minor matter."

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Hydrogen ions: Their determination and importance in pure and industrial chemistry, H. T. S. BARRON (*New York: D. Van Nostrand Co., 1929, pp. XIV+515, [pls. 5], figs. [99]*).—Though relations both to pure and to applied chemistry are considered, as indicated in the subtitle, the viewpoint of the book throughout is primarily the industrial and the technological. The volume constitutes the third of a monograph series devoted to applied chemistry and edited by E. H. Tripp. The chapter headings indicate its scope, as follows:

Theory of electrometric methods for the determination of H-ion concentrations; standard half-elements; the hydrogen electrode and pH; the quinhydrone electrode; the oxygen and air electrodes; metal-metallic oxide electrodes; the glass electrode; the measurement of electromotive force; modified potentiometric methods; the principles of volumetric analysis; solutions of known H-ion concentrations; colorimetric methods for the determination of H-ion concentrations; errors in indicator methods and the use of indicators in titrations; notes on the preparation of some indicators; the fundamental importance of H-ion concentrations in inorganic chemistry—the precipitation of hydroxides; precipitation of basic chromates, borates, carbonates, and silicates; dependence on H-ion concentration of the reactions between solutions of salts of hydroxides of low precipitation pH and the sodium salts of weak organic acids; precipitation of normal and basic phosphates; the importance of H-ion concentrations in the electrodeposition of metals; the importance of H-ion concentrations in the preliminary stages of leather manufacture; chrome tanning and other mineral tanning processes; the importance of H-ion concentrations of chrome tanning liquors; the importance of H-ion concentrations in the vegetable tanning of leather; the importance of H-ion concentrations in sugar manufacture; the importance of H-ion concentrations in pulp and paper manufacture; the importance of H-ion concentrations in brewing; the significance of the H-ion concentration of milk; the importance of H-ion concentrations in baking; water purification, corrosion, and sewage disposal; the bearing of H-ion concentration on the fertility of soils; H-ion concentrations and ceramics; the textile and dye industries; ore flotation; and miscellaneous industries.

Soluble silicates in industry, J. G. VAIL (*New York: Chem. Catalog Co., 1928, pp. 445, figs. 185*).—Following an introduction in which the history of soluble silicates is rapidly sketched, the subject of the manufacture and present applications of these compounds is taken up under the following captions: The constitution of silicate solutions, definite soluble silicates, reactions, preparation, commercial forms and properties, silicate cements, adhesives, sizes and coatings, deflocculation and detergency, gelatinous films and gels, and additional uses. The monograph is No. 46 of the American Chemical Society Series.

Bacterial metabolism, M. STEPHENSON (*London and New York: Longmans, Green & Co., 1930, pp. XI+320, figs. 34*).—"The aim of this book has been to

choose from the mass of data on the chemical activities of bacteria facts which may help us to gain an insight into the essential chemical processes accompanying the life of the organisms concerned." The present impossibility of forming a coherent picture of this process is clearly recognized; but the author none the less feels that "it is time that an attempt should be made to arrange the scattered data in order to appraise our knowledge of bacteria as living organisms apart from their rôle as disease germs or the bearers of commercially important catalysts."

The contents are as follows: Energy relations and fermentation: respiration; growth and nutrition; carbohydrate breakdown; the synthesis of polysaccharides, etc. ("viscous fermentation"); protein breakdown; nitrogen fixation; and the autotrophic bacteria.

Chemical and physico-chemical changes induced in wheat and wheat products by elevated temperatures, I, II, W. F. GEDDES (*Canad. Jour. Research*, 1 (1929), No. 6, pp. 528-558, pls. 5, figs. 8; 2 (1930), No. 1, pp. 65-90, figs. 4).—The results of the first two investigations of this series are summarized as follows:

"Heat treatments of wheat and wheat products were conducted in an apparatus which made it possible to study independently the influence of time, temperature, and moisture content. Straight-grade flour, milled from Western Canadian hard red spring wheat (allowed a limited amount of aging) heat treated for varying times at different temperatures and normal moisture content (13.9 per cent), was used in most of the studies. Baking tests conducted on this flour revealed progressive improvement in baking quality, as determined without bromate, with temperature or time of heating being extended within a certain range. No well-defined 'region' of improvement was observed. Improvement in baking quality was reflected in a better handling quality of the dough and, in the baked loaf, by a decrease in underfermented characteristics, and by a marked improvement in crumb texture. No significant alteration in loaf volume was observed. Improvement in baking quality induced by heat was not comparable in magnitude to that obtained by the addition of 0.001 per cent potassium bromate to the baking formula, but induced the same general characteristics in the finished loaf. Baking tests with bromate on heated flour revealed damage to baking quality for all heat treatments. Extension of time or temperature of heating, above the range where improvement was observed, caused pronounced damage to baking quality as determined with or without bromate. The damage caused was reflected in decreased loaf volume, overfermentation characteristics, and coarse texture. Within the range of damage, the baking quality was found to be approximately a linear function of the temperature for constant time of heating.

"Heat treatment resulted in a marked decrease in fermentation tolerance. This decrease could not be ascribed to lower diastatic activity, since baking tests after the addition of diastatic malt to the baking formula gave similar results. Increasing the moisture content at which heat treatments were conducted markedly reduced the temperature to which flour could be heated without damage to the baking quality. The safe temperature limit for various moisture contents has been fairly well defined. The limiting moisture content at which damage occurred for a fixed temperature and time of heating was very sharp. Heat treatment of wheats showed somewhat less damage to baking quality of the flour milled therefrom than heat treatment of flour under similar conditions.

"Studies were conducted on heat-treated samples of unbleached straight-grade flour milled from Western Canadian hard red spring wheat with the purpose of determining the influence of time and temperature of heating flour with nor

mal moisture content on certain biochemical properties related to 'strength.' Samples were selected which showed a progressive range in baking quality, including some which revealed improvement as a result of heat treatment, when baked by the basic procedure. Gluten quality was impaired in all heat-treated samples, as evidenced by decreased viscosity of leached, acidulated flour suspensions, a decreased rate and extent of imbibition of the washed out gluten, and decreased gas retention of the dough. High positive correlations between viscosity, gas retention, and loaf volume were obtained. The somewhat higher correlations between these measures of gluten quality and loaf volume when determined with potassium bromate added to the formula suggest that the bromate method gives a better measure of gluten quality than the basic procedure. Decrease in viscosity was approximately a linear function of the temperature, for constant time of heating.

"Ease of peptization of the flour proteins by N magnesium sulfate, N potassium iodide, and 5 per cent potassium sulfate solutions showed a marked and progressive decrease with increasing severity of heat treatment. The high positive correlations between the percentage of protein extractable by these salts indicate that the magnitude of these fractions is influenced by the same inherent qualities of the flour proteins. The high positive correlations between the percentage of protein peptized by these salts and viscosity suggest that these 'qualities' are the colloidal properties of the flour proteins. High positive correlations were obtained between loaf volume and percentage of protein peptized. Increasing the moisture content of the flour, with fixed time and temperature of heating, resulted in decreased peptization indicating more extensive heat denaturation of the gluten proteins.

"Fractionation of the flour proteins showed that the decrease in the potassium sulfate fraction with increasing severity of heat treatment contributed to both the gliadin and glutenin fraction (as determined by the direct barium hydroxide method). Diastatic activity, as determined by the modified Rumsey method and by the rate of gas production in doughs without added sugar, revealed only slight decreases with those flours which showed improvement in baking quality due to heat treatment. Marked decreases were observed with the more severe heat treatments. Susceptibility of the starch to diastatic action was unaltered until marked damage to baking quality resulted, when significant decreases were noted. Heat inactivation of diastase evidently occurred before changes in amylolytic susceptibility. Proteolytic activity markedly decreased with heat treatment, significant decreases being noted before diastatic activity was appreciably altered. The hydrogen-ion concentration of flour extracts revealed no particular trend due to heat treatment, but the buffer value was somewhat increased. The biochemical changes investigated were, for the most part, in a direction associated with decreased baking quality, and provided no adequate explanation for the improvement in baking quality observed in certain samples when baked by the basic procedure."

Buffer intensities of water extracts and suspensions of various flours at different H-ion concentrations, G. E. HOLM and E. GREWE (*Cereal Chem.*, 7 (1930), No. 1, pp. 43-58, figs. 9).—This contribution from the U. S. D. A. Bureau of Dairy Industry reports a study of various types and grades of flour, from which the principal conclusions were (1) that the water extracts of all of the types of flour used have a buffer intensity maximum in the range pH 6.5 to 7, the suspensions showing a like maximum in the range pH 5.75 to 6.25; (2) that "the average buffer intensity of the water extracts over a wide range of H-ion concentration varies from approximately 38 per cent of the average of the suspension in the high-grade flours to approximately 62 per cent in the lower grades"; and (3) that "buffer capacity is not strictly proportional

to ash content. The correlation between buffer capacity and ash content is not the same for high grade as for low grade flours."

Value of the viscosimeter in a commercial flour mill laboratory, A. R. SASSE and J. T. PEARSON (*Cereal Chem.*, 7 (1930), No. 1, pp. 79-82).—The authors consider it an inescapable conclusion from their experimental observations that "no method of using the viscosimeter is well enough standardized or widely enough used to be called the correct method. therefore the results are of little value outside the laboratory where obtained"; and they add that "in order to get at the quality of gluten it was necessary to eliminate the effect of varying amounts of protein, which was done by having the percentage of protein in the solution constant instead of holding the weight of the flour constant. The amount of ash in the flour was found greatly to affect the viscosity. Our final conclusion was that the viscosity test adds nothing to the information now obtained from the protein and ash tests and can never be made to take the place of the baking tests."

New aids in the ashing of flour, F. M. WALTERS (*Cereal Chem.*, 7 (1930), No. 1, pp. 83-87, figs. 2).—The author has studied the use of salts of zirconium, lanthanum, yttrium, cerium, and thorium with a view to their substitution for calcium salts as aids in the ashing of flour.

The use of lanthanum nitrate in accordance with the method stated below was found to improve upon calcium salts with respect to certain of the desiderata noted—the ability, namely, to fix inorganic radicals, to yield a definite compound (preferably a nonhygroscopic oxide) when present in excess, to render the ash nonhygroscopic, to render the ash infusible at ashing temperatures, and to accelerate combustion—and to be equal to that of calcium salts in other respects.

Method.—Two reagents are required. These are: Solution A—lanthanum nitrate in 40 per cent alcohol containing 0.75 mg. La_2O_3 per cubic centimeter (dissolve 1.9925 gm. lanthanum nitrate $[\text{La}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}]$ in 800 cc. of 40 per cent alcohol and dilute to 1 liter). Ten cc. of this solution evaporated to dryness and incinerated should leave a residue of La_2O_3 weighing 0.0075 gm. Solution B—lanthanum nitrate in 40 per cent alcohol containing 1.5 mg. La_2O_3 per cubic centimeter (dissolve 3.985 gm. of the nitrate in 800 cc. of 40 per cent alcohol and dilute to 1 liter). Ten cc. of this solution evaporated to dryness and incinerated should leave a residue of La_2O_3 weighing 0.015 gm.

The determination is described as follows:

"Into an ignited, tared, flat-bottomed silica dish, 65 mm. in diameter or larger, weigh 5 gm. of flour. Spread flour evenly over the bottom of the dish. For soft wheat flour add 10 cc. of solution A. For hard wheat flour add 10 cc. of solution B. By means of a light-weight stirring rod, bent at a right angle 1 cm. from the end, mix and work the solution into the sample until a uniform paste results, entirely free from lumps. Wipe the stirring rod with a small piece of ashless filter paper and add the paste to the sample. Place dish and contents directly into a muffle furnace heated to a bright cherry red. Leave in furnace until a carbon-free ash results (25 to 30 minutes). Cool in a desiccator and weigh, correcting the result by subtracting the weight of the La_2O_3 added."

Researches in milk sugar (*New York Cornell Sta. Rpt.* 1929, p. 29).—Report is made of a study of the manufacture of crude milk sugar from milk, of which the result was the development of a process yielding a much improved grade of the crude product together with improved economy of recovery from the milk, and of a method for preparing β -lactose on a practical scale. Attention is drawn to the practical importance (on account of the much more ready solu-

bility of β - than of α -lactose) of a process permitting the commercial substitution of the β - for the α -form of this sugar. The probability of the commercial production of β -lactose by the new process in the near future is noted.

Inedible animal fats in the United States, L. B. ZAPOLEON (*Food Research Inst. [Stanford Univ.], Fats and Oils Studies No. 3 (1929), pp. XV+353, figs. 3*).—The scope and character of the book are in general adequately represented by the chapter headings, which follow: Meat inspection in the United States; sources and volume of animal by-product and waste; products, their uses, and methods of marketing; sources of tallow and grease and methods of rendering; volume and trends of production in the tallow and grease industry; comparative output of slaughterers and renderers; production of inedible fat by meat packers; trend of slaughter and meat production under Federal and local regulation; the rendering industry; municipal reduction; feeding garbage to hogs; animal by-products—markets and consumption; and some questions of public and business policy. An appendix deals with the following topics: Commercial grades of inedible tallow, grease, and derivatives, and methods of sale; State regulations with respect to sale of commercial feed-stuffs; definitions of animal feedstuffs of animal origin, adopted by the Association of Feed Control Officials of the United States; methods of quoting prices upon tankage and cracklings; and distribution and occurrence of fats in the animal carcass.

The activity and nitrogen content of fractions obtained in the concentration of the antineuritic vitamin of brewers' yeast, A. SEIDELL (*Rec. Trav. Chim. Pays-Bas, 48 (1929), No. 9, pp. 855-859*).—Attention is called to accumulated evidence that the antineuritic vitamin is a nitrogenous compound, and that consequently fractions which have the highest activity on the basis of the amount of nitrogen they contain represent the most highly purified vitamin concentrates. For this reason it is thought that fractionation procedures controlled on the basis of nitrogen activity should furnish the best means of obtaining the antineuritic vitamin in a sufficiently pure condition to permit its chemical identification. The methods employed by the author for the fractional adsorption of the antineuritic vitamin from brewers' yeast by fuller's earth are described, with data showing the nitrogen content and activity of various fractions and calculations of the percentage recovery of the vitamin from the original material. In three successive fractions of activated fuller's earth a total of about 88 per cent of the quantity of antineuritic vitamin originally present was accounted for.

Attempts at purifying the antineuritic vitamin (water-soluble B factor) by fractional precipitation [trans. title], A. DE CUGNAC (*Bul. Soc. Chim. Biol., 11 (1929), No. 4, pp. 443-465, figs. 2*).—The author has applied the method of fractional precipitation to extracts rich in antineuritic vitamin prepared from brewers' yeast by the Seidell method (*E. S. R., 55 p. 609*), utilizing as solvents water, acetic acid, and formic acid and as precipitants alcohol, acetone, ether, and picric acid. Ethyl acetate was tested as a solvent both in the pure and hydrated form, but with negative results.

All of the fractions obtained were tested for activity on pigeons by the Seidell method (*E. S. R., 56, p. 203*), and some of the protective doses were compared with the ash content.

The activity of the various precipitates corresponded closely to that of the original product, but the nonprecipitable fractions were practically inactive. The slight variations in the activity of the precipitates were not at all proportional to the progressive stages of purification as measured by the variations in ash content. This is thought to indicate, as has been noted by a number of in-

investigators, that the apparent precipitation of vitamin B is really a phenomenon of adsorption rather than actual precipitation. The active precipitates were never in definite crystalline form, although some of the active preparations showed under the microscope a mixture of crystalline fragments and of amorphous material.

Attention is called to the value of formic acid as a solvent of vitamin B, particularly on account of its ability to dissolve the vitamin in the cold, whereas acetic acid dissolves active preparations only at the boiling temperature. It is noted that formic acid does not dissolve the material from activated fuller's earth, but that this is also true of other acids.

Determination of ash by direct weighing, J. L. SPALDING (*Cereal Chem.*, 7 (1930), No. 1, pp. 88-93).—The following conclusions are stated:

"The direct ash method is less susceptible to error due to the personal factor, because only one exact weighing, that of the ash residue, is necessary. Errors due to variations of humidity are eliminated in the direct method, the hygroscopic properties having been found to be within the limit of sensitivity of the balance. The direct method gives better and more uniform checks for both individual and collaborating laboratories. The time factor in weighing in the flour and weighing out the ash has been reduced from one-half to two-thirds that required by the A. O. A. C. method."

METEOROLOGY

Studies of contemporary changes in climate and vegetation [trans. title], F. ENQUIST (*Svensk Geogr. Årsbok*, 1929, pp. 7-50, pl. 1, figs. 23; *Eng. abs.*, pp. 48-50).—It is stated that since 1915 the climate of southern Sweden has become more continental, followed by reduced yields of winter wheat. "In Sweden winters of a continental type are throughout followed by meager winter wheat crops, winters of a maritime type by excellent crops. The climatical conditions of the summer seem to modify the yield of crops only slightly." It is suggested that this may furnish a basis for a method of predicting yields. In general, the author concludes that "the limits of distribution of plants are determined, as far as temperature goes, by the duration of maximum and minimum temperatures."

Climate and agriculture in Russia [trans. title], W. P. VON POLETIKA (*Ber. Landw. Reichsanst. Ernähr. u. Landw.* [Germany], n. ser., 9 (1929), No. 4, pp. 478-527).—This article describes the climatic characteristics of the different agricultural zones of Russia and shows the close dependence of the agriculture of the country upon soil and climatic conditions, especially the climatic extremes, which are quite pronounced.

Meteorological conditions of the growth of winter cereals with relation to the microclimate [trans. title], Z. A. RIJAZANTSEVA (S. A. RJASANZEWA) (*Zhur. Geofiz. i Met.* [Jour. Geophysics and Met.], 5 (1928) No. 3, pp. 221-233, *Ger. abs.*, p. 233).—Parallel observations on temperature at 15 cm. above the surface of the soil and 10 cm. below it on a drained swamp and on a near-by mineral soil showed an average minimum air temperature about 4° C. lower over the swamp soil than over the mineral soil. The temperature variations were wider and the danger of frost greater in case of the swamp soil than in case of the mineral soil, thus indicating that the conditions for growing winter cereals are less favorable with the former than with the latter.

Dependence of yield and sugar content of sugar beets on weather factors [trans. title], R. SCHULZE (*Zuckerrübenbau*, 11 (1929), No. 11, pp. 185-192; *abs. in Facts About Sugar*, 24 (1929), No. 49, p. 1162).—Correlating the meteorological data for 27 years in the beet growing district east of the Saale River

in Bavaria with the yield and sugar content of the beets, it was found that the "critical period" for this district is July–September, a rainfall of over 7 in. during this period being necessary for the maximum crop. Abundant rainfall with relatively low temperature and sunshine appeared to be the conditions giving the highest gross yield, but abundant sunshine (a daily average of more than 4.43 hours) in September and October was correlated with high sugar content.

The harmattan and atmospheric humidity, N. P. CHAMNEY (*Gold Coast Dept. Agr. Bul. 16* (1929), pp. 286–288, pls. 2).—Supplementing a bulletin dealing with the origin and phenomena of the harmattan season, previously noted (E. S. B., 60, p. 802), this article relates especially to the influence which the dry northeast wind, which prevails during this period, has on the atmospheric moisture. It is shown that "during the harmattan the air is very dry, due to the fact that the wind blows direct from the central deserts of Africa and has not encountered any large free water surface in its path. The temperature is high and the velocity of the wind about 8–10 miles per hour. These factors are favorable to rapid desiccation, and in consequence any objects which will yield moisture to the air, such as the foliage of plants, the skin of human beings, and even such things as furniture, books, etc., which have been hitherto in a moist climate are dried out."

The minimum temperature at different heights above the soil [trans. title], N. PASSERINI (*Atti R. Accad. Naz. Lincei, 6. ser., Rend. Cl. Sci. Fis., Mat. e Nat., 10* (1929), No. 11, pp. 582–584).—It is stated that the temperature was found to vary markedly with height above the soil (from 0.05 to 2 meters) at different seasons of the year and with changes in pressure, wind, relative humidity, and vapor tension.

SOILS—FERTILIZERS

[**Soil Survey Reports, 1925 Series**] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1925, Nos. 10, pp. 32, fig. 1, map 1; 11, pp. 80, pls. 3, fig. 1, map 1; 12, pp. 38, fig. 1, map 1; 13, pp. 59, figs. 4, maps 2; 15, pp. 42, fig. 1, map 1; 16, pp. 28, pl. 1, fig. 1, map 1; 17, pp. 53, fig. 1, map 1; 18, pp. 20, fig. 1, map 1*).—Of the 8 surveys of which the reports are here noted, Nos. 10, 11, 12, 13, and 18 were conducted in cooperation with the corresponding State experiment stations, and No. 10 also with that of the North Carolina Department of Agriculture. Nos. 15, 16, and 17 were carried out with the cooperation, respectively, of the West Virginia Geological Survey; of the Wisconsin Geological and Natural History Survey and the University of Wisconsin; and of the State Soil Survey Department of the Conservation and Survey Division, University of Nebraska.

No. 10. *Soil survey of Wilson County, North Carolina*, B. C. Journey and W. A. Davis.—Wilson County consists of a nearly flat to rolling area of 238,720 acres in east-central North Carolina. "Swamps or meadows occur along practically all the streams," of which the valleys are "narrow and comparatively shallow."

The most extensive of the 23 types found and here classified as 15 series was Norfolk sandy loam, 28.9 per cent of the county, other important areas being those of Norfolk fine sandy loam, 11.2 per cent, and Plummer fine sandy loam, 10.2 per cent, together with a total of 7 per cent of meadow and swamp.

"The soils of the county are deficient in organic matter and lime. They are also poorly supplied with phosphorus, nitrogen, and potash."

No. 11. *Soil survey of the Salinas area, California*, E. J. Carpenter and S. W. Cosby.—The Salinas area is a generally well drained tract of 488,966

acres in the central coastal section of California. Somewhat less than one-third of the area is in a mountainous region, 29.3 per cent being classified as rough mountainous land, while the remainder offers agricultural lands of varying surface features.

Chualar sandy loam, 9 per cent, is the most extensive among a total of 35 types here classified as 23 series.

No. 12. *Soil survey of Warren County, Iowa*, A. M. O'Neal and R. E. Devereux.—Warren County, south-central Iowa, contains an undulating to strongly rolling area of 364,800 acres of loess-covered drift plain, for the most part amply drained.

Shelby loam, which occupies 29.1 per cent of the total area of the county. Tama silt loam 25.1 per cent, Wabash silt loam 11.6 per cent, and Grundy silt loam 11.1 per cent, are of notable extent among a total of 26 types representative of 15 series.

No. 13. *Soil survey of Hidalgo County, Texas*, H. W. Hawker et al.—Hidalgo County consists of an area of 1,009,920 acres of a smooth, nearly flat plain in the southern part of Texas. Surface drainage, in a large part of the county, is slow.

Brennan fine sandy loam, constituting 30.5 per cent of the county, is the most extensive single type, followed by Nueces fine sand with 17 per cent, and Hidalgo fine sandy loam 10.5 per cent. In all, 12 series were found and subdivided into 23 types. Special mention is made of irrigation and alkali problems.

No. 15. *Soil survey of Monroe County, West Virginia*, J. A. Kerr.—Monroe County amounts to an area of 302,720 acres of generally very hilly or mountainous lands. The soils of this area are classified as 19 individual series and two composite groups and are subdivided into 34 types, of which Meigs silt loam, with 13.5 per cent of the county, and DeKalb shaly silt loam 13.2 per cent, are the most extensive.

Of rough stony lands 0.7 per cent only are listed as such, unclassified. Stony soils described either as nonagricultural or as so stony, steep, or inaccessible as to be best adapted to forestry, are included among the classified types, however, to a total areal extent of 25.4 per cent of the county.

No. 16. *Soil survey of Calumet County, Wisconsin*, W. J. Geib et al.—Calumet County is located in the east-central part of the State and contains 204,800 acres of lands, for the most part gently rolling and undulating but in part more nearly level.

The mineral soils found in Calumet County represent 13 series and 23 types, of which Kewanee silty clay loam occupies 26.2 per cent of the total area of the county, Bellefontaine silt loam amounting to 23.5 per cent, and Superior clay loam 13 per cent. Organic soil is represented by peat 9.4 per cent.

No. 17. *Soil survey of Nuckolls County, Nebraska*, L. A. Wolfanger et al.—Nuckolls County is situated on the southern boundary of the State and comprises 370,560 acres of level lands in the Prairie Plains region. Of 22 soil types and 16 series which were found, Crete silt loam, which occupies 42.8 per cent of the total area of the county, and Holdrege silt loam which follows with 34 per cent, are much the more extensive.

No. 18. *Soil survey of Hyde County, South Dakota*, J. A. Machlis and B. H. Williams.—Hyde County, in central South Dakota, has a total land area of 551,040 acres and lies within the glaciated section of the Great Plains, possessing a relief typical of glaciation. Drainage is better established in the southern than in the northern part of the county. Williams loam, covering a total of 55.4 per cent of the entire area of the county, is the most extensive

of the 11 soil types and 7 series, Williams silt loam following with 20.8 per cent.

[*Soil Survey Reports, 1926 Series*] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1926, Nos. 2, pp. 27, fig. 1, map 1; 3, pp. 57, pls. 2, fig. 1, map 1; 4, pp. 63, pls. 4, fig. 1, map 1; 5, pp. 35, fig. 1, map 1; 6, pp. 47, fig. 1, map 1; 7, pp. 30, fig. 1, map 1*).—The six survey reports of this series were carried out in each case with the cooperation of the corresponding State experiment station, the North Carolina Department of Agriculture also assisting in the cases of surveys Nos. 6 and 7.

No. 2. *Soil survey of Moody County, South Dakota*, W. I. Watkins and G. A. Larson.—For the most part undulating or gently rolling in surface, Moody County lies just south of the central point of the east boundary of the State. The county has a land area amounting to 329,000 acres and is provided, for the most part, with good drainage.

The soils are classified into 23 types of 9 series, with 1.3 per cent of rough stony land. With several phases Moody silt loam occupies 50.3 per cent of the area and is followed in areal importance by Barnes loam with 16.6 per cent.

No. 3. *Soil survey of Willacy County, Texas*, H. W. Hawker and C. S. Simmons.—Willacy County consists of 354,640 acres of level, undissected plain in the extreme southern point of the State. The county is without definite drainage channels, a condition attributed to low average rainfall and soil porosity.

The most extensive among the 17 soil types, of 8 series, inclusive of a composite of Lomalto and Nueces soils, are Victoria clay loam with 21.8 per cent, Willacy fine sandy loam with 21.8 per cent of the county, and Nueces fine sand with 13 per cent.

No. 4. *Soil survey of the Oroville area, California*, E. J. Carpenter et al.—The Oroville area includes 326,400 acres of lands of varying surface and drainage conditions, mostly within the boundaries of Butte County, northern California.

Of the 29 soil types and 20 series, Stockton clay adobe, amounting to 25.1 per cent of the total area, and Marvin silty clay loam totaling 11.2 per cent, are the areally important soils. Tailings and rough broken and stony land amounting, respectively, to 2 and 3.4 per cent, are also mentioned.

No. 5. *Soil survey of Carroll County, Iowa*, A. M. O'Neal and R. E. Deverenz.—Carroll County possesses an area of 366,720 acres and lies in the west-central part of the State. The surface is in general gently undulating to nearly level. Natural drainage is effective in the southwestern half of the county but parts of the eastern section require artificial drainage.

The soils of Carroll County as here mapped and described consist of 11 series inclusive of 20 types, of which Marshall silt loam leads with 38.6 per cent of the total area. Carrington loam follows with 19.5 per cent.

No. 6. *Soil survey of Nash County, North Carolina*, W. D. Lee and S. B. Bacon.—Nash County consists of 351,360 acres of piedmont plateau and coastal plain soils located in northeast North Carolina and provided with drainage generally good but ranging from inadequate to excessive, the last-named condition giving rise to serious erosion.

The largest soil areas of the county are Chesterfield sandy loam (19.5 per cent) and Bradley sandy loam (12.2 per cent). A total of 29 types are classified as 19 series, with meadow, unclassified, 3.1 per cent.

No. 7. *Soil survey of Rockingham County, North Carolina*, R. C. Journey and W. A. Davis.—Rockingham County, northern North Carolina, has an area of 364,800 acres of rather high dissected plateau. Drainage, though gen-

erally effective, ranges from poor enough to require ditches to a run-off so rapid as to cause erosion injury.

Cecil clay loam amounting to 29.6 per cent of the total area, and Cecil sandy loam amounting to 24.5 per cent, are of outstanding areal extent among 15 types representing 11 series, besides 0.4 per cent of unclassified meadow.

Macon County soils, R. S. SMITH, E. A. NORTON, E. E. DETURK, F. C. BAUER, and L. H. SMITH (*Illinois Sta. Soil Rpt. 45* (1929), pp. [2]+67, pls. 2, figs. 14).—Located in east-central Illinois. Macon County occupies an area of 371,769 acres of gently rolling plain now generally well drained by a system of combined natural and artificial drainage ways.

The soils of this area are here divided into the four main groups of upland prairie soils (63.93 per cent of the total area of the county), upland timber soils (11.35 per cent), terrace soils (0.3 per cent), and swamp and bottom land soils (3.45 per cent). The remaining 0.97 per cent consists of lake surface. Most extensive among the 13 color texture types named are a brown silt loam and a black clay loam, both of the upland prairie group, these types occupying, respectively, 64.71 and 18.54 per cent of the total area of the county.

An appendix contains the usual explanations for the interpretation of the soil survey and general information on the principles of soil fertility; and a supplement gives some experiment field data from the Mt. Morris, Dixon, Kewanee, Bloomington, Aledo, Hartsburg, and Vienna fields.

Soil Survey of Chickasaw County, Iowa, C. L. ORBEN and F. R. LESH (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.], Ser. 1927, No. 1, pp. 35, fig. 1, map 1*).—Chickasaw County occupies an area of 318,060 acres in northeastern Iowa. The surface is that of an undulating drift-covered plain, in part dissected by small streams.

The soils, as mapped and described in this report, prepared in cooperation with the Iowa Experiment Station, comprise 18 types and 2 phases representing 10 series. Carrington silt loam, covering 26.8 per cent of the entire surface of the county, is the most extensive type, and is followed in order of aggregate area by Carrington loam, occupying 16.9 per cent, Clyde silty clay loam 12.8, and Floyd silt loam 11 per cent.

Subsoil an important factor in the growth of apple trees in the Ozarks, A. T. SWEET (*U. S. Dept. Agr. Circ. 95* (1929), pp. 12, pls. 5, fig. 1).—Within the limits, at least, of the region studied, there was demonstrated a very definite relation between conditions obtaining in the subsoil and the growth and health of apple trees.

With the deeper root penetration found to occur in the open subsoils the trees were larger, produced better, and lived longer than did trees grown over tight subsoils. It was found that under conditions favorable with respect to the subsoil structure an apple tree 20 years old possessed a root system penetrating and feeding upon 5,000 cu. ft. of soil, whereas the tight subsoil limited the supply to less than half this volume of soil.

"The study, while calling attention to the importance of good care, emphasizes the fact that control of disease, cultivation, and fertilization, which may seem to overcome the handicap of tight subsoil when the orchard is young, can not overcome it as the trees become older and their demands greater."

[Agricultural chemistry investigations of the California Experiment Station] (*California Sta. Rpt. 1929, pp. 32, 33*).—Under this head are noted a continuation of alkali investigations (E. S. R., 61, p. 317) and a further study of base-exchange phenomena.

Inoculation of sulfur prior to its application to alkali soils was found to have little effect upon the rate of oxidation in the soil. The fineness of grinding of the sulfur, on the other hand, was shown to have a very important bearing on the effectiveness of the application, and it is stated that the material to be applied should be fine enough to pass a 100-mesh sieve.

It was found possible to reclaim the Fresno alkali soil by drainage and leaching alone. The delay in obtaining profitable crops, however, was of such length, when only drainage and leaching were applied as reclamation measures, as to justify sulfur applications. Gypsum also, if of adequate quantity, gave good results.

In the base-exchange work the probable identity of the soil base-exchange complex constant of mass action with the corresponding constant of the mineral bentonite was established. The active material was also determined to be apparently a monovalent, rather than a divalent, aluminosilicic acid.

"In both cases X-ray examinations indicate that the base-exchange material is a definite chemical substance and that it occurs as extremely small crystals. The base on or near the surface of these crystals is replaceable. The interior of the crystal is composed largely of a magnesium compound; whereas on or near the surface the magnesium had been replaced to a greater or less extent by other bases, the extent of which depends upon circumstances. In ordinary soils calcium has largely replaced the magnesium on the surface of the particles; in alkali soils sodium has performed the same rôle. The exchange substance occurs as a component of the colloidal material and is therefore a product of weathering. It is not, however, an adsorption compound in the ordinary sense but rather a true chemical compound formed as a result of weathering."

In the case both of the bentonite and of the soil the grinding of the sample markedly increased the exchangeable proportion of magnesium.

Soil technology (*California Sta. Rpt. 1929, pp. 96-100*).—Soil moisture studies by C. F. Shaw indicated that a 2-in. soil mulch is effective only when the water table is within capillary rise of the surface. The hydrometer method of making mechanical analyses was found by R. L. Perry and Shaw to be quite unreliable as compared with the direct centrifugal sedimentation method. Studies by G. B. Bodman and Doughty showed at the lower moisture contents wide differences between the vapor pressure and water content of colloidal material extracted from soils but much closer agreement in their vapor pressures when more moist. The hydrogen peroxide-hydrochloric acid method of pretreatment of soils in mechanical analysis was found by Bodman in some instances no more satisfactory than a simpler and less expensive method. A logarithmic relationship was found to exist between the ease of flow and the moisture content of the soil.

Extended soil temperature studies by A. Smith indicated that the lag or delay in reaching the maximum or minimum as compared with the air temperature varied from approximately 0.5 hour for the 0.5-in depth to 80 hours for the 36-in. depth. At shallow depths average daily temperatures showed considerable variation when calculated from 96 as compared with the usual 3 readings, but the changes were slight for depths beyond 12 in.

Potatoes grown under paper mulch produced from 6.01 to 27.18 per cent more in weight of clean tubers than under soil mulch. The paper-mulched plots contained slightly more of moisture and possibly of nitrate nitrogen. Soil temperatures at 3-in. depths were several degrees higher than bare plots, but there was practically no difference at 12-in. depths.

Smith and F. W. Flint found the alcohol method for soil moisture unsatisfactory for general use.

A fundamental study of the mechanism of buffer action in soils, P. B. MYERS and G. M. GILLIGAN (*Delaware Sta. Bul.* 162 (1929), p. 27).—The colloidal material has been extracted from a Sassafras silt loam in a manner similar to that previously described (E. S. R., 60, p. 713), and a portion of the extracted material was submitted to electrodialysis until only a trace of dialyzable material was obtained in 2-3 hours. The buffer action exhibited by the colloidal material disappeared after electrodialysis. As similar results have been obtained with Portsmouth and Chester loams, it is concluded that "the salts thus formed when acid is added to the original colloidal material are evidently responsible for the buffer action and not the colloidal material itself."

[Soil acidity work at the Delaware Station] (*Delaware Sta. Bul.* 162 (1929), pp. 20, 21).—Two items are here very briefly noted.

Soil acidity studies, Newark, H. C. Harris.—A partially completed investigation of the effect of prolonged fertilizer treatment upon the buffer capacity of a Sassafras silt loam indicated "that the long-time fertilizer treatments on either the limed or unlimed plats have had no marked influence on the buffer capacity of this soil. Apparently lime has had considerable influence in this respect. . . .

"The relation of crop growth to soil acidity has been further studied on Sassafras silt loam. This year alfalfa, timothy and clover, bluegrass, snap beans, beets, cabbage, and tomatoes are being grown on the acidity plats. Alfalfa and beans show marked differences on the lime and sulfur plats. Extremes in both cases seem to be injurious. To a lesser degree the same results were found in the timothy and clover plats."

Acidity studies, Milford, G. L. Schuster and H. C. Harris.—Hydrated lime and sulfur were used to effect changes in the soil reaction, electrometric pH determinations were made, and a variety of crops was grown. Numerical results, including pH values, are given in detail in two tables and the general statement is made that "the studies with alfalfa indicate that a moderate amount of lime is essential on Sassafras sandy loam soil for good growth. Excessive applications of lime are not beneficial and may be injurious. Similar results prevail as to the growth of crimson clover. Wheat and soybeans seem to tolerate more extreme acid and alkali conditions than will alfalfa or crimson clover."

The basicity of Texas soils, G. S. FRAPS and E. C. CARLYLE (*Texas Sta. Bul.* 400 (1929), pp. 20, fig. 1).—In connection with investigations of cotton root rot studies of soil basicity are reported. The basicity of the soil, as the term is here used, is measured by the amount of acid neutralized by the soil expressed as carbonate of lime. The methods for basicity are described.

"The buffer capacity as here described is the amount of acid required to change the intensity of the acidity to a desired extent. The buffer capacity for bases as here discussed is expressed as parts per million of sulfur in the form of sulfuric acid required to change the soil to a pH of about 4.6. The methods are described. The buffer capacity averages from 24 to 92 per cent of the basicity measured by 0.02 N acid and a smaller percentage, 21 to 42 per cent of the basicity, measured by 0.2 N acid. Only from 6 to 23 per cent of the lime and magnesia soluble in strong acid acts as buffer under the conditions here discussed. In each case the percentage available for buffer action increases with the basicity of the soil. A large proportion of the lime and magnesia dissolved by strong acid from soils is present as silicates which do not have the power of neutralizing weak acids. The buffer capacity is larger if the acid is allowed to remain in contact with the soil 6 to 8 days than in 24 hours, the routine method.

"Elemental sulfur is oxidized in the soil to sulfuric acid, which consumes the bases of the soil. At room temperature the change occurs somewhat slowly. It is difficult to estimate exactly the amount of elemental sulfur required to produce a desired change in the acidity of the soil."

Some time relations of buffer capacities, as above defined, to specified degrees of acidification by given quantities of sulfur are stated, and a map shows the local occurrence of various grades of surface soil basicity.

Pot and lysimeter experiments, H. C. HENRICKSEN (*Porto Rico Sta. Rpt. 1928, pp. 28, 29*).—The effects of various treatments upon the growth of citrus seedlings and trees grown in containers permitting the control and study of soil conditions are reported. In the case of seedlings in half barrels of sandy clay soil given a variety of fertilizer treatments the results are stated as follows:

"The pH of the soil was 6.3 at the beginning of the experiment and dropped to 5.3 in less than three months in the series receiving ammonium sulfate and potassium sulfate. In the next series, which received calcium phosphate in addition to these two substances, the pH remained practically stationary. In the series receiving urea and potassium phosphate, the pH remained practically stationary. In another series, in which sodium nitrate was substituted for urea, the pH increased slightly. These results indicate that the changes in pH were caused by such ions of the various salts as were not taken up by the plants.

"In one series, which received sulfur at the rate of 1 ton per acre in addition to complete fertilizer, a pH of 3.8 was produced within two months. Some of the plants were killed outright; the rest made very little growth. Replantings were made from time to time, but growth was practically nil as the pH remained around 4. This indicates that the critical soil pH for citrus trees lies between 4 and 5. In another series, which received air-slaked lime at the rate of 1 ton per acre, the pH was barely raised beyond 7, and it did not affect plant development."

Plant nutrition (*California Sta. Rpt. 1929, p. 86*).—"Culture studies made with soils of high fixing power for potassium show that plants may effect an almost quantitative removal of potassium added to the soil and fixed in the base exchange complex, provided the root system can develop in contact with the soil containing the fixed potassium. In some soils the nonreplaceable potassium is found to be of far greater physiological importance than in other soils. In connection with the absorption of potassium by plants, reciprocal relations of this element with calcium and magnesium are of importance, and may have a bearing on certain nutritional diseases of plants."

In some soils of high phosphate fixing power, highly soluble phosphate was found rapidly to assume a form in which it was unavailable to plants even under conditions of adequate root contact. Progress of a study of concentrated fertilizers with a view to the choice of sources of phosphate tending to retard fixation is noted.

Factors that influence nitrogen fixation in soils, T. F. MANNS (*Delaware Sta. Bul. 162 (1929), pp. 67-74, figs. 4*).—In a critical study being made on the influence of fertilizers, lime, and manure on the nitrogen status in the soil, nitrogen removal was estimated from crop yields, and the soil nitrogen conditions were ascertained from analyses of composite samples from 5 areas in both the limed and unlimed sections of the field. The results thus far obtained are tabulated, represented graphically, and discussed in some detail.

The course of dextrose metabolism and nitrogen fixation by *Azotobacter*, P. G. KRISHNA (*Centbl. Bakt. [etc.] 2. Abt., 76 (1928), Nos. 8-14, pp. 228-240, fig. 1; abs. in New York Cornell Sta. Rpt. 1929 p. 18*).—In studies at the New

York Cornell Experiment Station, the accumulation of the products of the metabolism of the organism was shown not to depress the nitrogen-fixing activity. Neither the dextrose concentration, nor, during an incubation of two weeks, the number of cells constituting the inoculum had any apparent effect upon the nitrogen fixation. Fixation continued as long as energy material was available, but the daily quantities of nitrogen fixed and of dextrose consumed were variable. A good correlation between daily dextrose consumption, nitrogen fixation, and carbon dioxide evolution indicated a period of maximum cell multiplication and energy utilization coincident with the nitrogen fixation maximum.

From 65 to 70 per cent of the carbon content of the dextrose consumed appeared as carbon dioxide. The ratio carbon assimilation to nitrogen fixation was found to be from 35:1 to 36:1, the carbon-nitrogen ratio within the *Azotobacter* cells being from 6.5:1 to 8:1.

The optimum reaction was found between pH 6.3 and 8.4, the acid limit lying between pH 5.8 and 5.9.

The disappearance of nitrates under timothy, L. G. JONES (*Jour. Amer. Soc. Agron.*, 20 (1928), No. 11, pp. 1167-1176; *abs. in New York Cornell Sta. Rpt. 1928*, p. 17).—The behavior of nitrate nitrogen applied for timothy at various ages of the crop on Dunkirk silty clay loam and of similar treatments applied to the vegetation-free soil was followed through a period of 14 months. The nitrate disappeared rather rapidly from the timothy sod, and more completely from such sod than from the bare soil. On the cropped soil the crop, roots and tops taken together, accounted for the applied nitrogen. It was noted also that "at certain stages of growth the crop contained considerably more nitrogen than was contained in the added nitrate. Considering the nitrogen of the crop as 'conserved,' there was a net gain of total nitrogen by the soil where timothy was growing. The figures, although not entirely conclusive, indicate that added nitrate may be lost from bare soil of this type by denitrification."

Management of cane soils, J. O. CARREÑO (*Porto Rico Sta. Rpt. 1928*, pp. 12-16).—Experiments in extension of those upon the utilization of nitrogen by cane soils reported as concluded in 1927 (*El S. R.*, 60, p. 719) are detailed.

A study was made of the rate of decomposition, under laboratory conditions simulating those of the field treatment of the soils investigated, of sugarcane trash added to the soil, and observations on the disappearance and reappearance of soil nitrates were recorded. The effect of the various treatments upon the rate of decomposition of the trash was followed by means of determinations of the carbon dioxide evolved, and nitrate concentrations were determined at weekly intervals.

"Carbon dioxide production was increased considerably by the addition of the cane trash and further increased by the addition of lime. Green trash decomposed more rapidly than the dry trash or a mixture of the two, regardless of whether the soil was limed or not. . . . Unlimed soil showed 31.3 parts per million nitrogen as nitrates, and soil plus lime, 52 parts per million, whereas the rest of the flasks revealed only traces. Thus decomposition had not progressed sufficiently in 31 days to allow nitrification."

A further trial of the effect of adding nitrogen in the nitrate form and of mixing the trash with the soil as compared with leaving it on the surface as a mulch had the result that "again the addition of trash was followed by greatly increased carbon dioxide production showing rapid decomposition of the trash. A more active rate of decomposition followed upon the addition of lime. The addition of nitrogen was not followed by increased carbon dioxide production, probably because only 30 parts per million nitrogen as nitrates was added. This represents an addition of only 0.2 per cent nitrogen in the

amount of trash added. The amount of carbon dioxide production was considerably increased even when the trash was left on top of the soil as a mulch, but it was slightly below that produced when the trash was mixed with the soil. As to the nitrate-nitrogen content of the soil at the close of the experiment, a decided advantage was shown by the mulched soils over those mixed with trash. Mulched soils showed the presence of considerable nitrate nitrogen even when they were slightly below soils receiving no treatment; on the other hand, soils mixed with trash showed only traces of nitrates even in the pots receiving nitrates in addition."

Other work of a similar character is described; and the general conclusion stated was that "apparently decomposition of cane trash, whether air-dried green or dead trash, or a mixture of the two, progresses rapidly enough in two months' time to permit formation of much-needed nitrate nitrogen in such quantities as are necessary to plants. This action is greatly hastened by adding lime to the soil, and, while decomposition is not apparently hastened by adding nitrogen in its nitrate or ammonia forms, the earlier reappearance of nitrate is thereby obtained. When the trash is applied as a mulch the denitrifying action does not appear to be as vigorous as when the trash and the soil are mixed, presumably because of the contact of the small amount of trash with the soil. Such trash is kept moist and decomposes, whereas the rest is well aerated, dries rather quickly, and is not therefore acted upon; hence, denitrification is reduced. As soil moisture is reduced, soils appear to gain in nitrate content, whereas the addition of water to restore that lost by evaporation reduces nitrates in samples receiving trash. This action, though not definitely known to occur, may be beneficial, for the reduction of the nitrates to some organic form may prevent loss by leaching."

Testing fertilizers, spring, 1929, L. D. HAIGH (*Misouri Sta. Bul. 276* (1929), pp. 12).—Analyses are reported based on the usual inspection of fertilizers distributed during the shipping season from January to June, 1929.

Analyses of commercial fertilizers, fertilizer supplies, and home mixtures for 1929, C. S. CATECART (*New Jersey Sta. Bul. 490* (1929), pp. 35).—This bulletin makes a preliminary report for 1929 of the usual fertilizer analyses.

AGRICULTURAL BOTANY

Magnesium and calcium requirements of the tobacco crop, W. W. GARNER, J. E. McMETREY, JR., J. D. BOWLING, JR., and E. G. MOSS (*Jour. Agr. Research* [U. S.], 40 (1930), No. 2, pp. 145-168, figs. 6).—Magnesium deficiency, recognized in the field by the breaking down of both the green and the yellow chlorophyll pigments, beginning with the lower leaves and with the tip of the leaf and shown in the cured product by abnormal thinness and non-elasticity of the affected areas, was found upon analysis to be associated with a decline in the leaf below a minimum content of 0.25 per cent magnesium or 0.4 per cent magnesia. At the minimum requirement magnesium was somewhat higher in the upper than in the lower leaves, with that of the stalk at about the average of all leaves. In the presence of a liberal supply of magnesium the highest percentage content was in the lower leaves, and that of the stalk was considerably lower than the average of the leaves. The minimum magnesium requirement for a crop of 1,000 lbs. of leaf and 500 lbs. of stalk is estimated at about 6 lbs. of magnesium oxide per acre. Magnesium deficiency was found widely prevalent on sandy and sandy-loam soils, especially in seasons of heavy rainfall.

Preliminary studies suggested that when highly concentrated fertilizers containing neither magnesium nor calcium are used on sandy soils, tobacco often makes poor growth, and that this can be corrected by adding water-soluble magnesium plus calcium. Magnesium alone stimulated growth but induced growth abnormalities.

Preliminary studies indicated that the minimum calcium content of the leaf required to prevent deficiencies is in excess of 1 per cent. In the absence of adequate calcium, small quantities of soluble magnesium may cause toxic symptoms. The beneficial effects of applying superphosphate and dolomitic limestone as a counteraction for soluble magnesium toxicity are discussed.

Effects of various treatments on the carbon dioxide and oxygen in dormant potato tubers, O. SMITH (*Hilgardia* [California Sta.], 4 (1929). No. 11, pp. 273-306, figs. 5).—Respiration determinations upon Irish Cobbler and White Rose potatoes dug at various stages of maturity showed higher activity at the time of digging in the immature tubers. Respiration gradually declined with maturity in the field and in storage at 25° C., the decline being much more rapid in storage. Determinations of the amounts of gas extracted from small whole tubers suggested that the decline in respiration rates results partly from the development of the periderm layer. White Rose tubers had a higher respiration activity and a shorter rest period than the Irish Cobbler.

Subjection of tubers to 0.75 cc. of 40 per cent ethylene chlorhydrin per liter of space for 24 hours, followed by moist storage at 25°, tended to shorten the rest period and greatly increase the gaseous exchange as compared with no treatment and dry storage. In fact, moist storage at 25° was found in itself to be highly effective in breaking the rest. Analyses of the interior gases in relation to the rate of carbon dioxide loss and oxygen absorption suggested that chemical treatments and moist storage facilitate the exchange of gases in potato tubers. Tubers stored moist at 25° in air and 60 per cent oxygen absorbed much more oxygen than did dry-stored tubers but gave off only slightly more carbon dioxide in a 48-hour period. Comparisons of the amount and composition of the gas withdrawn from peeled and unpeeled whole tubers indicated that not only the periderm but also the interior tissue retards the passage of carbon dioxide and oxygen.

The effects of desiccating winds on citrus trees, H. S. REED and E. T. BAETHOLOMEW (*California Sta. Bul.* 484 (1930), pp. 59, figs. 18).—Hot, dry winds blowing under certain conditions of barometric pressure from inland deserts to the Coastal Plain cause extensive damage to citrus trees by defoliation, twig killing, and loss of fruit. The fruit that remains is often materially reduced in size. Evidence was found that the death of twigs and small limbs is due largely to a stream of brown viscous material returning from the scorched leaves rather than to direct injury. Where leaves drop quickly, as in the lemon, twig injury was markedly less. Defoliation of orange and grapefruit trees was due principally to wind burn and scorch, while in the lemon tree defoliation was largely the result of mechanical force of the wind.

The water content was greater in young than in mature orange leaves, but the latter transpired more rapidly and were more quickly injured. A large proportion of the transpiration occurred through the upper, cutinized leaf surface which contained no stomata. The total content of soluble solids and the viscosity of the sap were much greater in the older leaves, but the sugar content was considerably higher in the young leaves.

That cultural practices are important was evident in the fact that trees with a healthy root system suffered less injury. Trees whose vitality was low due to any cause, such as insects or fungus attack, were usually more severely

injured. The minimum damage occurred in groves where rational tillage and fertilizer practices were followed in conjunction with the development of suitable windbreaks. The relation of various factors, windbreaks, oil sprays, irrigation, cultivation, fertilizers, etc., to the general problem is discussed.

GENETICS

[Genetic studies at the California Station] (*California Sta. Rpt. 1929*, pp. 38, 39, 79-83, 102, 103, 104, 105).—In presenting the usual annual report (E. S. R., 61, p. 326) it is stated that some resistance to yellows was found in dwarf tomatoes and their hybrids and in the Red Pear variety. The canning varieties, Cal 1 and Cal 2, yielded fruit of very high quality. Two new $2n+1$ chromosome mutant forms of tomato were found. On the assumption that triploids arise from the union of diploid and haploid gametes, in the case of one triploid recently found the diploid gamete is known to have originated by the reduction of a tetraploid mother cell.

In citrus work considerable progress was made in the reduction of thorniness by the selection of thornless bud wood, usually from the highest branches. Of 1,200 hybrids, all of ordinary diploid parentage, 50 were listed as possibly triploid, and of 6 of these actually studied 4 were found to be triploid. In 7 triploids examined, irregularities of cytokinesis were abundant. In the pollen mother cells of triploids, trivalent first metaphase chromosomes were apparently generally formed, but univalents were common. Triploids produced seedless or nearly seedless fruits and varied greatly in productivity.

A study of the chromosome constitution of reverting forms of trisomic or tetrasomic *Matthiola* supported the hypothesis that these bud variations are due to the loss of one or two chromosomes. Studies in the Snowflake variety and in colored hybrid double-thrower types indicated that the genetic behavior of the trisomic form called Slender will aid in eliminating most of the single-flowered progeny as young seedlings. F_2 ratios from crosses with pure single races indicate that in the Crenate trisomic and also in its fragment secondary, Slender, the extra chromosome carries the locus of the genes determining single and double blooms. Normal diploids, and, so far as observed, other trisomics other than the above mentioned usually approximated the F_2 ratio, three single to one double, as expected in disomic inheritance of doubleness.

Genetic studies with *Crepis* reported on briefly dealt with the taxonomic relationships, the number and morphology of the chromosomes in 67 species of *Crepis* (by [E. L.] Hollingshead and E. B. Babcock), triploidy in *C. capillaris* (by [M.] Navashin), and interspecific hybrids (by Hollingshead, J. Clausen, Babcock, and [J. L.] Collins).

In studies of the influence of X-rays and radium radiation (E. S. R., 62, p. 215), it has been found that earth radiations may play an important part in the origin of species of animals and plants. Babcock and Collins compared the rate of occurrence of sex-linked lethal mutations in *Drosophila melanogaster* at the experiment station and in a street-car tunnel in San Francisco where the natural ionizing radiation is twice that at the experiment station. Of 3,481 individual males tested at the experiment station, no male flies were produced by 9, or 0.26 per cent. There were 13 males among 2,500 treated in the tunnel which produced no male offspring, indicating 0.52 per cent of sex-linked lethal mutations. The difference was calculated as 0.275 ± 0.086 , substantiating the association of the amount of radiation with the mutation rate.

Cytological studies of horticultural varieties of avocado and of other species showed a typical diploid chromosome number of 24. Studies by H. Van Elden

and R. W. Hodgson of the avocado flowers supported the observations of earlier workers to the effect that there are two general periods of opening and closing, and that a pronounced rhythm exists in the opening and closing of flowers of any one variety. At the first opening the pistil was receptive but no pollen was discharged. At the second opening the pistils were broken down but pollen was shed. Whether fertilization is possible in this second stage was not established. Rhythmic opening was most pronounced when the weather was clear and was more evident in the Guatemalan than in the Mexican races. Varieties could be grouped in two classes according to their habits of flower opening. Since some flowers in both stages of opening were always observed, even in a single cluster, it is pointed out that self-pollination is not impossible. Van Elden found the avocado embryo to be in the proper stage for fertilization at the time of the first opening.

Studies with cabbage showed that the white corolla which occasionally appears in this species is due to a single dominant factor. Self-sterility of cabbage is believed inheritable, making possible the isolation of self-incompatible families.

The Golden Plume and Golden Self Blanching celeries were found generally self-fertile.

Certain inbred strains of *Antirrhinum* were found highly resistant to rust.

Inheritance and linkage relations of virescent seedlings in maize, I. F. PHIPPS (*New York Corn Coll. Sta. Mem.* 125 (1929), pp. 63, figs. 2).—The genetic interrelations between 12 different virescent corn seedlings, v_1 to v_{12} were studied, and their linkage relations with other known factors in corn were determined. The virescent seedlings v_1 to v_6 , inclusive, and v_7 were reported on by Demerec (E. S. R., 52, p. 727; 55, p. 526) and v_8 and v_9 by Carver (E. S. R., 57, p. 721).

The 12 factors, v_1 to v_{12} , appeared to be genetically different from one another and from v_1 to v_6 , inclusive, and fine striped. Virescent 2 was found to be identical with the virescent studied by Lindström (E. S. R., 39, p. 825). The characters observed to be linked are listed, with their respective percentages of crossing-over.

Virescent 8, a lethal virescent, was linked very closely with the factor pair concerned in the production of tunicate ear (*Tu tu*), which is sterile in the homozygous condition. Therefore, a plant of the constitution $v_8 tu/V_8 Tu$, termed a "balanced heterozygote," when self-fertilized will produce three genotypes, only one of which can be self-fertilized and perpetuate the type. This one genotype will be of exactly the same constitution as the parent. This type of behavior seems to simulate the "balanced lethal" situation in *Drosophila*, reported by Muller (E. S. R., 41, p. 867).

Chromosome fragmentation and mutation in tomato, J. W. and M. M. LESLEY (*Genetics*, 14 (1929), No. 4, pp. 321-336, figs. 12).—In a study at the Citrus Experiment Station, Riverside, Calif., of the progenies of triploid and trisomic forms of tomatoes, three plants were found with portions of chromosomes in addition to the normal diploid complement. One plant had one unpaired chromosome in addition to a fragment. One of the mutants appeared in the progeny of a double trisomic selfed, one in an F_1 of a double trisomic \times diploid, and the third in the F_1 of a triploid \times diploid cross. The author discusses the behavior of the fragments during the maturation of the pollen mother cell and in inheritance. The fragments were transmitted both by ovules and pollen, but not to the expected degree.

The effect of X-rays in producing somatic genovariations of a definite locus in different directions in *Drosophila melanogaster*, N. W. TIMMONS

RESSOVSKY (*Amer. Nat.*, 63 (1929), No. 635, pp. 118-124).—The author reports the production of two cases of somatic mutations and one reverse somatic mutation among 1,407 flies produced from X-rayed eggs of homozygous *sc w^e ec* individuals. The somatic mutations were identified as white areas on the eyes of red males. One male showed some darker facets which were considered as due to reverse mutations in the gene *w^e*.

In another experiment X-raying of eggs and larvae of *W**w* females mated with *w* males produced 2,986 white-eyed flies, of which 1 male had a red area on the eye and 1 had an area lighter than normal red. Of the 775 red males produced there were 6 with white areas, while in the 786 heterozygous red females there were 15 with 18 white areas on the eyes.

It is concluded that somatic mutation from *w^e* to *w* is less frequent than from *W* to *w*. There was but one reverse mutation from *w* to *W* and one mutation from *w* to a light red in 2,986 flies, and only one reverse mutation from *w^e* to *W* in 1,407 flies from treated eggs. The occurrence of abnormalities in further breeding from the progeny of the X-rayed flies is mentioned.

Investigations on the genetics of rosettes in the guinea pig [trans. title], A. PICTET and A. FERRERO (*Ztschr. Induktive Abst. u. Vererbungslehre*, 52 (1929), No. 2-3, pp. 236-286, pls. 5).—A study of the inheritance of the rough hair characteristic in the guinea pig has indicated that there is a single dominant factor for rough designated by *R*. In the absence of *R* the individual is smooth. Other factors determine the location and character of the rosettes. A dominant factor *G* causes their generalization over the body, while the recessive *g* limits the rosettes to the lumbar region. In the presence of *R* another dominant factor *D* permits the development of rosettes on the head, which is smooth in the homozygous recessive. The authors suggest that the strain used in this investigation differed genetically from the strain used by Castle and Wright (*E. S. R.*, 39, p. 877) in the study of the inheritance of the rough characteristic.

Observations on interspecific hybrids of the fowl, A. S. SEREBROVSKY (*Jour. Genetics*, 21 (1929), No. 3, pp. 327-340, pls. 2, fig. 1).—The author calls attention to the possibility of studying the genotypic formula of certain species in crosses with other species for which the genetic constitution is known. Examples are cited from crosses between the common fowl and *Gallus varius*, the guinea fowl, and the Mongolian pheasant, between the guinea fowl and the turkey and pea fowl, and between various species of pheasants, as observed in the Berlin Zoological Museum.

Genetic studies in poultry.—VII, Notes on polydactyly, R. C. PUNNETT and M. S. PEASE (*Jour. Genetics*, 21 (1929), No. 3, pp. 341-366).—In continuing this series (*E. S. R.*, 59, p. 522), a study of the data on polydactyly from numerous experiments conducted for other purposes, including those noted (*E. S. R.*, 25, p. 869), indicated that there is a definite factor for polydactyly in fowls. In one set of experiments the polydactylous factor appeared to be dominant. In other experiments, however, it was found that 4-toed birds could carry the factor, indicating the presence of an inhibitor for polydactyly. In still other cases 5-toed birds were apparently able to carry the inhibiting factor, thus leaving the final interpretation somewhat in doubt.

The influence of sex-linked factors on infant mortality [trans. title], W. SCHIRMER (*Arch. Rassen u. Gesell. Biol.*, 21 (1929), No. 4, pp. 353-393, figs. 20).—The author cites data on the infant mortality from European and other countries for a period of years from about 1900 to 1926, all of which show a greater mortality of boys than girls at birth and during the infant period. This condition is considered to be due to the operation of recessive lethal factors.

Breeding experiment to show that fecundity is an inherited character (*New York Cornell Sta. Rpt. 1929, pp. 60, 61*).—The results of 20 years' breeding work involving the mating of high-producing birds in an effort to increase egg production are compared with the mating of low- to medium-producing birds. During the last 14 years egg production increased 78 eggs per bird in the first year in the high-line birds, whereas in the low-line the increase was but 32 eggs per bird. In 1928 the high-line birds averaged to lay the first egg at 209 days of age, while the low-line birds required 231 days to become sexually mature. The eggs produced by both lines improved in shape and color and increased approximately 4 gm. in average weight. During 15 years' experiments the body weight of the birds in the high line increased nearly 1 lb., while those in the low line increased about 0.5 lb.

[The hormone of the anterior hypophysis for diagnosing pregnancy] (*California Sta. Rpt. 1929, p. 58*).—Studies of the value of the maturity hormone of the anterior hypophysis indicate that this substance may be used in diagnosing pregnancy in the mare as early as the fortieth day of gestation. The hormone has been found in recognizable amounts in the blood of the pregnant mare up to the one hundred and fortieth day of gestation.

Uterine bleeding as an early sign of pregnancy in the monkey (*Macacus rhesus*), together with observations on the fertile period of the menstrual cycle, C. G. HARTMAN (*Bul. Johns Hopkins Hosp., 44 (1929), No. 3, pp. 155-164*).—The author describes six cases in monkeys of uterine bleeding as a sign of pregnancy. This condition began from the thirteenth to twentieth day after conception and continued for an average of 21 days. It resulted from the leakage of blood into the lumen of the uterus from the uterine glands.

On the placentation of a macaque (*Macacus rhesus*), with observations on the origin of the blood constituting the placental sign, G. B. WISLOOKI and C. G. HARTMAN (*Bul. Johns Hopkins Hosp., 44 (1929), No. 3, pp. 165-185, pls. 3*).—The character of the placenta and associated organs of a 7.5 mm. monkey embryo is described, with more detailed information on the origin of the uterine bleeding as a sign of pregnancy noted in the above article.

The quantitative theory of sex, G. BONNIER (*Amer. Nat., 63 (1929), No. 685, pp. 186, 187*).—An attempt is made to show the correlation between Goldschmidt's theory of sex control on the basis of male- and female-determining substances and the chromosome control of sex as advanced by Bridges based on the paper of Dobzhansky and Bridges.¹

Sex determination in the animal and plant kingdoms [trans. title], R. GOLDSCHMIDT (*Biol. Zentbl., 49 (1929), No. 11, pp. 641-648*).—After discussing the factors responsible for sex determination in plants, based on the presentation by Correns,² the author concludes that his theory for sex determination in animals is equally applicable to plants.

Some observations on sperm dimorphism, G. L. MOENCH and H. HOLT (*Biol. Bul. Mar. Biol. Lab., Woods Hole, 57 (1929), No. 5, pp. 267-271, figs. 2*).—Measurements of the head length of spermatozoa from man and the pig failed to show the bimodal distribution which has been reported by several authors. This discrepancy is discussed with the conclusion that the sperms do not fall into two groups on the basis of head length.

¹ The Reproductive System of Triploid Intersexes in *Drosophila melanogaster*, T. Dobzhansky and C. B. Bridges. *Amer. Nat.*, 62 (1928), No. 632, pp. 425-434, figs. 3.

² Bestimmung, Vererbung und Verteilung des Geschlechtes bei den höheren Pflanzen, C. Correns. *Handbuch der Vererbungswissenschaft*. Berlin: Borntraeger Bros., 1928, vol. 2-C, pp. III+138, figs. 77.

FIELD CROPS

[Agronomic work in California] (*California Sta. Rpt. 1929, pp. 52-57 63, 64, 65*).—Continued investigations are reported as heretofore (E. S. R. 61, p. 327).

Flax varieties planted by J. W. Gilmore in September made greatest vegetative growth and usually the most seed in comparison with later plantings, although they were damaged most by frost. The experiments indicated that on land properly adapted and prepared flax may become a profitable crop in the interior valleys of California. At Davis cotton required a much longer time to attain full size of boll (average 24 days) and to open (40 days) than in areas regularly adapted to cotton. With ramie the process of extraction that suggested best results consisted of cutting the plants at the proper stage with a binder, soaking the bundles about 6 hours in water, freezing them for 24 hours, and scutching and washing. Evidently retting the frozen stems in water for about 3 days tends to produce a finer and a whiter fiber.

In tests by J. P. Conrad, higher yields of small grains were obtained by fertilizing from 35 to 67 days after planting than at planting. Fertilizing small grains where they normally follow sorghum is thought likely to prove economically feasible.

Studying sorghum root development in relation to soil moisture, Conrad and F. J. Veihmeyer obtained data indicating that soil moisture under sorghum plants apparently was extracted in successive zones, and that the extraction was progressive whenever no material additions of moisture occurred during the growing season. A correlation between intensity of root development and the extent of soil desiccation by root activities was shown for the conditions existing. Ratios of soil moisture percentages to their respective moisture equivalents, criteria of the relative wetness of the soil, may be used to indicate the development of roots under certain conditions, e. g., a relatively dry soil indicating the presence of roots. Several new grain sorghum forms of economic promise under observation by G. W. Hendry combined the early maturity and large seed characteristics of White durra with the dwarf stature and erect headed characters of Dwarf Spur feterita, kafir, and White Yolo.

Notable increases in the yield of both grain sorghums and cotton were obtained in the Imperial Valley by B. A. Madson and L. G. Goar after plowing under green manure crops. Alfalfa also did much better following manures than on untreated soil. The beneficial effect seemed to be due largely to the improved physical condition of the soil. Frequency of cutting of alfalfa, according to studies by Madson and C. Mauk, does not in itself deplete the carbohydrate reserves but only when accompanied by an abundance of water and probably also by an optimum temperature for growth.

The scope of cultural, fertilizer, and irrigation tests and breeding work with sugar beets is outlined. Date-of-planting tests with sugar beets demonstrated that a satisfactory sugar content and a good tonnage can be obtained by planting beets early in the fall, possibly leading to the development of a beet sugar industry in the Imperial Valley.

The leaders in varietal studies of barley, wheat, and oats by G. A. Wiebe in cooperation with the U. S. Department of Agriculture are indicated, with comment on frost injury. The amount of damage from frost depended upon the particular stage the plant was in rather than any difference between varieties. Club Mariout barley, White Federation and Pusa 4 wheat, and Kanota oats were found to be the best varieties for late spring seeding. W. W. Mackie obtained complete resistance to stem rust of oats in a cross between

Kanota × Richland, the hybrid being like Kanota in character. Red and yellow kernels in a cross between Kanota (red) and Richland (yellow) segregated in a 3:1 ratio with red dominant. Mackie also reported that *Zea mays amylaeasaccharata*, not noted for many years, has been recovered from plants grown by the Hopi Indians.

[Agronomic work in Delaware], G. L. SCHUSTER, C. E. PHILLIPS, and H. C. HARRIS (*Delaware Sta. Bul. 162* (1929), pp. 12-20).—Investigations with field crops reported on currently and for various periods included fertility-rotation experiments, pasture tests, fertilizer tests with sweetpotatoes, and variety tests with wheat, soybeans, red clover, and alfalfa.

In pasture experiments the highest average acre yield, 7,630 lbs. of air-dry grass, came from a manured and limed plat and the second highest, 6,250 lbs., from a plat receiving superphosphate, potassium chloride, and lime. The acre costs per season of these plats were, respectively, \$11.15 and \$4.00 more than an unmanured and untreated plat which produced 3,340 lbs. per acre. The grass mixture giving the heaviest production on the soil (Sassafras silt loam) was timothy 4 lbs. per acre, red top 4, orchard grass 3, Kentucky bluegrass 4, Canada bluegrass 3, white Dutch clover 3, alsike clover 3, and Japan clover 6 lbs.

Two cuttings of alfalfa per season produced the largest yield at the least labor cost, although the hay did not have the quality or feed value possessed by alfalfa cut three times per season. Four cuttings were severe on the stand and were not economical. Canadian variegated and Dakota Grimm alfalfa evidently were not suited to conditions in southern Delaware.

In a study of the factors influencing the amount of sterility in the basal spikelets of wheat, microscopic studies indicated that sterility was due to the dwarfing and disappearance of the reproductive organs, first the stamens disappearing and then the ovaries. Observations on fertilizer plats revealed no evidence that sodium nitrate, superphosphate, potassium chloride, or complete fertilizer had any influence upon the amount of sterile spikelets.

[Field crops work at the Georgia Coastal Plain Station, 1928], S. H. STARR (*Georgia Coastal Plain Sta. Bul. 11* (1929), pp. 7-20, 22-44, 52-56, 69-71).—Outstanding varieties over periods in continued comparisons (E. S. R., 60, p. 132) included Georgia Red wheat; varieties of the rustproof group of oats, as Bancroft, Hundred Bushel, and Appler; Abruzzi and French rye; strains of Toole, Cleveland, Cook, and Express cotton; prolific corn, as Whatley, Hastings, and Garrick; North Carolina, Chapman Pride, Improved Spanish and Spanish peanuts; Ootootan soybeans; Tracy Early Black and 120-Day running velvetbeans; Austrian Winter field pea; Monantha, woolly-podded, and hairy vetch; Southern Queen, Golden Beauty, McMillan Cluster, and Triumph sweetpotatoes (for yields of No. 1 roots); Red Bliss and Irish Cobbler potatoes; and the lighter tobacco types, as Yellow Pryor, Jamaica, Cash, and Bonanza.

Seeding tests showed October 15 to November 1 to be the optimum period for planting small grains in the region, with a 4-pk. acre rate for wheat. Appreciable increases in oats yields have resulted from liberal applications of superphosphate and green manure. Liberal applications of potassium have increased oats yields and prevented lodging, and profitable increases were obtained from nitrogen fertilizers applied February 1 to 15. Recommendations for oats were 400 lbs. of 10-0-4 fertilizer (P-N-K) at planting and 100 lbs. of sodium nitrate or its equivalent in a similar carrier applied February 1.

Fertilizer tests with cotton indicated that a 9-3-5 formula was a most efficient combination on the various phases of Tifton sandy loam soils, with slightly more nitrogen and potassium on the poor, run-down black pebble soils. On good soils, with proper management, from 800 to 1,000 lbs. of fertilizer

may be used profitably. In a complete fertilizer, quickly available inorganic carriers of nitrogen, as sodium nitrate or ammonium sulfate, gave much better results than organics. Potassium in the form of kainite gave better yields than from other sources. Results during 5 years indicated that from 100 to 125 lbs. of sodium nitrate or its equivalent in a similar fertilizer applied just before squaring may be used profitably. Substantial increases in yields of cotton, corn, and oats resulted from green manuring and use of complete fertilizer, but no benefits came from liming. Only small differences in cotton yields resulted from use of very concentrated formulas, as compared with the less concentrated fertilizer mixtures, when the fertilizer was mixed carefully with the soil. Spacing tests suggested 2 plants in hills spaced 12 in. apart for highest yields.

The relatively high yields of corn resulting from applications of 10-2-4, 8-2-6, and 10-0-6 formulas indicated the value of potassium for the crop on coastal plain soils. It appeared advisable to apply fertilizer to corn as a side dressing; on very poor soils at least half might be applied at planting.

Further evidence of the need of a complete fertilizer for peanuts was had. On land having leguminous green manures turned under before peanuts, nitrogen applied in the fertilizer affected yields little, although the phosphorous and potassium showed profitable increases. A 10-2-4 fertilizer is suggested tentatively for peanuts. The closer spacing, 6 in., and narrower rows, 18 and 24 in., returned the highest yields. Soybeans responded to complete fertilizer with increased hay yields.

In cutting tests from March 1 to May 1, winter field peas made heaviest yields on April 15, at which time maximum growth was attained. Winter field peas evidently should be turned under not later than March 1 for cotton and March 15 for corn. The earliest seedings, October 1 to 15, gave the largest tonnage of green manure at the time of preparing land for corn and cotton. Increased yields came from seeding as much as 60 lbs. per acre, although 35 to 40 lbs. is the usual rate. Seeding with the grain drill gave the best yields of green manure, and the lightly-plowed in seedings were second best. Notable responses resulted from application of potassium, whereas the phosphorus and nitrogen were of doubtful value.

Seeding tests with vetches indicated October 1 to 15 and the use of the grain drill with 25 lbs. per acre of hairy vetch and 35 to 40 lbs. of Monantha vetch. Vetches responded actively to fertilizers, especially potassium. Hairy vetch did not attain maximum growth before May 1, while Monantha made growth enough by March 1 to 15 to justify its use as green manure preceding cotton and corn.

The combination of carpet grass, Dallis grass, and lespedeza proved superior to either sown alone on lowland pasture. Weights during the past three seasons indicated that on mixed seedings on moist lowland, sods which will carry from 1 to 1.5 mature animals per acre may be obtained. Carpet grass proved invaluable in establishing sods on moist lowland where native vegetation grows profusely, whereas lespedeza and Dallis grass were found to be poorer sod makers and when sown alone were often crowded out in two to three seasons.

Sweetpotato (Porto Rico) yields decreased regularly with deferment of planting date from April to August 1, and yields from April 10 plantings increased progressively as the harvest date was delayed from July 1 to November 1. When plants were set from 4 to 28 in. apart in 3.5-ft. rows total yields were increased by close spacing, although very little increase in No. 1 roots resulted. The highest yields in row width tests came from 3-ft. rows in which plants were spaced 16 in. in the drill and fertilized with 800 lbs. of an 8-4-4 fertilizer per

acre. In triangular tests, highest yields centered around the use of an 8-4-4 fertilizer formula. About 800 lbs. of fertilizer could be applied profitably. Indications were that half the nitrogen in sweetpotato fertilizer should come from an organic and half from a mineral source. Constant increases in yield in both Porto Rico and Big Stem Jersey varieties resulted from increased rates of application of fertilizer.

Results during 3 years indicated that one-fourth of the vines on sweetpotato plants may be cut away with little detrimental effect, but when as much as half the vines are cut decided decreases occur in yield. The yields of marketable roots were in inverse proportion to the amount of vines cut away. While yields resulting from the various parts of the vines differed very little, the base or woodier part of the vine seemed less desirable. Whole sweetpotatoes as seed produced a total yield larger than from vines or draws, while the yield of No. 1s was less. Of the 160 bu. obtained from whole sweetpotatoes, 115 bu. were jumbo or "mother potatoes," due to the fact that the whole sweetpotato when planted resumes growth and develops into rough, irregular, over-sized sweetpotatoes, so that very few new roots are formed. The tip ends and stem ends of Porto Rico potatoes did not differ appreciably in color of crop or yields.

The source of sweetpotato seed stock, northern or southern, did not have much influence on yields in the South. Porto Rico, producing 100 bu. of No. 1 roots per acre led the early maturing varieties and also yielded more marketable stock in a given number of days than did Big Stem Jersey, the highest yields of both coming from early planting. The average percentage of storage rot over periods ranged from 8 in Southern Queen and 9 in Triumph to 49 in Big Stem Jersey.

With potatoes an 8-4-4 fertilizer appeared to best advantage. Although yields rose with applications up to 1,200 lbs. per acre, 800 lbs. seemed to be a profitable limit. Whole tubers outyielded halves and quarters, yet the increased cost made their use unprofitable. Tip ends and stem ends gave like yields. Sets treated with lime outyielded by several bushels those untreated or dipped in sulfur and nearly doubled the yield from sets treated with sodium nitrate solution.

Tobacco fertilizer experiments on Norfolk loamy sand and Tifton sandy loam soils suggested for profit to use at least 80 lbs. of phosphorus, 30 of ammonia, and 50 of potash per acre on all soils, i. e., 1,000 lbs. of an 8-3-5 fertilizer. On the lighter soils, such as the Norfolk series, heavier application of all three elements will pay, and heavier applications of phosphorus and potash could be used to advantage on the Tifton soils. Plants receiving insufficient potassium or none began breaking down soon after growth started and were much more susceptible to disease than those getting enough potassium. Carrier tests led to the recommendation that the potassium sulfate and chloride should be used in such proportion that the chlorine in the fertilizer will total from 2 to 2.5 per cent. The organic nitrogen carriers, such as cottonseed meal and dried blood, showed up best on the well-drained Tifton soils, while the inorganics were best on the flat and poorly-drained Norfolk soils. Stable manure gave excellent results on both soil types and when available is advised at the rate of from 2 to 4 tons per acre sprinkled in the drill from 10 to 14 days before planting. Promising inorganic nitrogen carriers included urea, sodium nitrate, ammonium nitrate, and ammonium sulfate, and among the organics, dried blood and acidulated fish scrap gave favorable results. Such highly concentrated forms as ammonium phosphate and potassium nitrate when used together to make up a complete fertilizer offered little promise.

Spacing tests so far indicated that with tobacco plants spaced 2 by 4 ft. the returns per acre are in proportion to the quantity of fertilizer used up to 1,600 lbs.

of 3-3-5 fertilizer. Closer spacing decreased the yield and net returns per acre. When tobacco was grown in rotation with tobacco, cotton, corn, peanuts, sweetpotatoes, and small grains, and cover crops also were used, the results indicated that the problem is principally a question of nematode control. It was evident that such crops as cotton and sweetpotatoes have no place in a tobacco rotation, and so far no cover crop was found to be suited. About the only crops found to be safe in a tobacco rotation were corn and small grains, and peanuts where harvested and the vines taken off.

Plant breeding (*New York Cornell Sta. Rpt. 1929*, pp. 37-40, 40-43).—The principal activities of the station in breeding work with field beans, corn, sunflowers, red clover, alfalfa, soybeans, timothy, wheat, oats, barley, and potatoes are reviewed.

[**Field crops work in Porto Rico in 1928**], D. W. MAY, T. B. McCLELLAND, and R. L. DAVIS (*Porto Rico Sta. Rpt. 1928*, pp. 5-7, 9, 10, 13, 19, 20-22, 22-24, figs. 2).—None of the clovers and allied plants under trial from 5 to 20 years, including red clover, mammoth trefoil, lespedeza, sweetclover, alfalfa, bur, subterranean, crimson, and white clovers, grew successfully from the first plantings of the seed or established themselves by reseeding, although the seed was inoculated with the proper bacteria and nodules formed on the roots. Growth was poor, and in most instances the plants failed to mature.

Velvetbeans have proved satisfactory for forage and grain, soil improvement, and cover crops. On cut-over land unproductive for years in the station forest plantation, only the velvetbean, of many annual legumes tested, made a large yield. Velvetbeans grown on nut-grass infested areas completely smothered out the weed. Uba cane, another valuable forage crop, has made 33 tons per acre in 9 months on hill land.

When yautias, dasheens, and Penang taros were grown under daily light exposures of 10 and 15 hours at 8 weeks after planting, the dasheens and taros had developed longer and broader leaves and all three had developed longer petioles under the longer exposure. Comparative tests showed the highest yield of Penang taro to come from cormels weighing 2 oz. or less, next 3 oz., and the lowest from large cormels. 6 to 11 oz. Extremes differed by about 8 per cent, and annual yields varied from year to year. Since the large cormels are valuable as food and are more likely to rot than the smaller cormels, the latter evidently should be preferred for planting.

Other activities described briefly included production and comparisons of selfed lines and hybrids of corn and trials of introduction, hybrids, and seedlings of sugarcane, study of variable viability of sugarcane seed from arrows of the same variety (E. S. R., 62, p. 522), and varietal trials with potatoes.

The present status of legume inoculation in New York, H. J. CONN (*New York State Sta. Circ. 114* (1929), pp. 6).—Examination of 33 cultures of commercial legume inoculants on sale in New York showed that 9 of the agar preparations were evidently worthless and the other 13 apparently satisfactory. Uniformly satisfactory cultures were not obtained from any one manufacturer. Of the soil preparations, three or four were apparently satisfactory, while the other five or six contained so many foreign bacteria that their value could not be judged by laboratory examination alone. The merits of different types of inoculants are discussed briefly.

Canada-Leaming corn, D. F. JONES and W. R. SINGLETON (*Connecticut State Sta. Bul. 310* (1930), pp. 183-195, figs. 4).—Canada Leaming, an F_1 hybrid of selected inbred strains of Canada Yellow flint and Leaming dent, is characterized by large stalk growth and heavy grain yield and ripens early enough to give a good quality of silage in short seasons. It has been outstanding in comparisons at both Connecticut stations and the New York Cornell Station.

Results of cotton variety tests, 1926-1929, H. B. TISDALE and J. T. WILLIAMSON (*Alabama Sta. Circ. 55 (1930), pp. 8*).—Varietal trials with cotton during the period indicated showed D. & P. L. 4-8, Cook 1010 (Williamson), Delfos, Trice, and Cook 1627 to lead in order in yields in north Alabama (14 tests), and D. & P. L. 4-8, Dixie Triumph, Cook 1627, Cook 588, and Cleveland (Piedmont) in central Alabama (9 tests). In comparisons of wilt resistant varieties in central and south Alabama (19 tests) Cook 307 (Rhyne), Dixie Triumph, Toole (Council), Lewis 63, and Cook 307 (Bridges) led during the years 1926-1929.

Important factors in cotton growing in North Carolina, P. H. KIME (*North Carolina Sta. Agron. Inform. Circ. 46 (1930), pp. [1]+4*).—Important factors in the economical production of cotton discussed include soils, preparation, planting, varieties, spacing, cultivation, picking and storage, ginning, and care of seed for planting.

Some effects of greensprouting seed potatoes, E. V. HARDENBURG (*Amer. Soc. Hort. Sci. Proc. 25 (1928), pp. 91-96; abs. in New York Cornell Sta. Rpt. 1929, p. 75*).—Green-sprouted Green Mountain potatoes came up much earlier in the greenhouse than did the unsprouted, while with Rural the plants from the unsprouted seed came up slightly earlier. There was no marked difference in time of coming up in the field trials. The number of stems per plant was somewhat reduced by green-sprouting in both locations. In the field trials a consistently better stand of plants came from the ungreened lots. Although a greater maximum height of plant was maintained by the green-sprouted lots, the more rapid early growth rate of these plants was exceeded later by the unsprouted cultures so that the latter produced the greater total stem length. The green weight of tops for each lot was about the same.

The number of tubers per plant and per stem was consistently higher in both varieties in the plants from green-sprouted seed. Similarly, the green weight of all tubers and of tubers weighing more than 1 oz. was higher in the green-sprouted cultures grown in the greenhouse. In the field trials, although the percentage of U. S. No. 1 tubers was in all cases higher in the green-sprouted lots, the total yield and the U. S. No. 1 yield per acre were higher only in the Green Mountains. Equally significant yield differences in favor of the ungreened seed were obtained in the Rural variety. A greater stolon number, corresponding to the greater tuber set, resulted in the greenhouse from the green-sprouting process. No significant effect on either stolon or root weight was observed.

Effect of cultural methods and maturity upon the seed value of eastern Nebraska potatoes, H. O. WERNER (*Nebraska Sta. Research Bul. 45 (1929), pp. 45, figs. 15*).—The influence of cultural practices and maturity on seed potatoes was studied with the Early Ohio and Irish Cobbler varieties during 1921 to 1927, inclusive, largely at the station. See also an earlier note (*E. S. R., 61, p. 824*).

Early planting, straw mulching, and irrigation all increased the current crop yield. During practically any season and with any cultural system planting in April permitted at least 75 per cent of the crop to be harvested by August 15. Spindle tuber was less apparent in the straw-mulched than in the cultivated plots. Late planting, i. e., in late May and June, resulted in such a greatly reduced yield as to render the practice impractical in eastern Nebraska. Late planting yielded more with a straw mulch than with ordinary culture.

Tubers harvested just before vines were ripe in August, 1925, contained less dry matter, protein, sugar, and starch than tubers harvested in October. Straw-mulched potatoes contained more dry matter and starch but less protein and

sugar than the cultivated stocks, and irrigated potatoes were lower in dry matter, protein, sugar, and starch than nonirrigated tubers.

When 5 per cent or less of spindle tuber was present in the station plats the increase of the disease varied in the different lots according to the culture, increasing more in cultivated than in straw-mulched stocks and more in early than in late plantings.

Planting seed lines infected with spindle tuber in comparison showed straw-mulched stocks to be more productive than cultivated stocks, and late-planted or early-harvested stocks to excel early-planted or late-harvested lines, respectively. Seed from late planting was superior to that of about the same maturity secured by early harvesting. Planting and harvesting dates affected seed grown with cultivation more than that straw mulched. Irrigation was a negligible factor in so far as seed potato productivity was concerned. Seed stocks that had run out at the station due to spindle tuber infection were not rejuvenated by straw mulching.

Healthy seed stocks grown in isolated places or maintained in a healthy condition by growing parent plants under insect-proof cages exhibited much smaller yield differences than when spindle tuber was present. Late-planted seed was somewhat more productive than early-planted stock, and straw-mulched stock was slightly superior to that cultivated. The degree of dormancy of the seed tubers at planting and the occurrence of tuber production at a favorable or unfavorable climatic period in the trial year were factors affecting yield. The nitrate content of the soil did not seem to influence seed potato productivity.

Good seed stock, with less than 1 per cent of spindle tuber, planted in eastern Nebraska produced tubers satisfactory for use as seed, although after a second year in the section the seed value was small because of increase in spindle tuber.

Sorgo for sirup production: Culture, harvesting, and handling. H. B. COWELL (*U. S. Dept. Agr., Farmers' Bul. 1619 (1930), pp. 11+38, figs. 12*).—Detailed information is presented on cultural methods and field practices for growing and handling sorgo for sirup, on the utilization of the sirup and by-products, and on diseases and insects likely to attack the crop.

Soybean utilization. W. J. MORSE (*U. S. Dept. Agr., Farmers' Bul. 1617 (1930), pp. 11+28, figs. 11*).—The utilization of soybeans for human food, livestock, oil, hay, pasture, silage, soilage, and soil improvement and the uses of soybean meal and straw for feed and fertilizer are detailed, with summary accounts of various feeding tests involving soybeans at different State experiment stations.

Agricultural seed. A. S. LUTMAN (*Vermont Sta. Bul. 306 (1929), p. 8*).—Important findings in the analysis for purity and germination are described for 366 samples of agricultural seed collected from dealers in Vermont during 1929.

HORTICULTURE

[Horticultural investigations at the California Station] (*California Sta. Rpt. 1929, pp. 34-38, 44, 45, 93, 100-102, 103, 104, 109-111*).—The citrus fertilizer experiment (El. S. R., 61, p. 334), in which differential treatments were not begun until the trees were 10 years old, has already shown after 3 years beneficial effects of certain fertilizers. The trees receiving 2 and 3 lbs. of nitrogen per tree, partly in the form of dairy manure, were in general in fine condition as compared with unfertilized trees. The larger the amount of

nitrogen applied with straw the better the results. Heavy applications of straw markedly increased the penetration of water and necessitated modifications of irrigation practices. To date yields have not been significantly affected by fertilizer treatments. Concerning soil nitrates, it was found that throughout most of the season where furrow irrigation is practiced 75 per cent or more of the nitrate nitrogen is in the upper 3 ft., sometimes in the top 6 in.

In the Rubidoux tract, where cultural studies have been carried on with orange and lemon trees since 1907, the supplementing of clean culture with winter cover crops caused striking responses in growth and yield. The use of nitrogen on apricot trees in a cooperative trial at Hemet gave marked responses in yield and vigor. The fruit of the nitrated trees ripened from 7 to 10 days later than that of the unfertilized.

Rootstock studies have shown that small and off-type seedlings should be discarded, as this fraction contains almost all the inherently weak and dwarfish types. If followed by the elimination of the smaller budded trees the balance was found of high grade. In studies of the chemical relationships of scion and stock in citrus it was found that the soluble magnesium as a percentage either of the dry matter or of the soluble ash of the trunk bark was lowest in the lemon and sour orange and highest in the sweet orange and grapefruit. Values in the bark varied according to the scion variety with which combined. Chemical tests were developed for identifying various citrus rootstocks. The inarching of unthrifty lemon trees in Ventura County increased size but had no other response. Roots taken from profitable old trees were successfully propagated. The walls of the juice vesicles of orange fruits were found to contain impermeable substances which prevented water loss in periods of high evaporation.

Statistical analysis of apricot pruning data showed an influence of pruning on yield in only three of nine years. Yields are believed determined by other factors and are not affected except by drastic pruning. Trunk growth was associated with productivity in the following year.

Elberta, Alexander, Red May, Red Bird, Florence, and Foster peaches and the Stanwick nectarine were successfully utilized by G. L. Philp for pollinating the J. H. Hale peach. The Stanwick nectarine was self-fruitful.

Appleman failed to find starch in the orange tree at any stage of development.

As determined by R. W. Hodgson, summation totals of temperature are higher in regions of high temperature maxima than in regions of lower maxima, suggesting that above a certain point temperatures may not be utilized in fruit ripening. This optimum maximum is thought to lie between 90 and 95° F.

Studies by A. Hilmy of the structure of the citrus leaf as influenced by certain environmental factors indicated that stomatal count in the lemon, grapefruit, and sweet and sour oranges is higher in soils kept continuously at high moisture content and lower under conditions of partial shade, though in shade the stomata were larger. Fairly consistent specific differences were found in the number of stomata in the four species. Stomatal number per leaf appears to be determined when the leaves are from 2 to 3 weeks old. Stomata distribution was uneven in mature leaves, the greater number being at the basal and apical portions and the least along the main vein and sides. H. Van Elden found consistent differences in the thickness of the palisade cell layers of the orange and lemon and also differences in the structure of exposed and shaded leaves.

Fig trees irrigated every 2 weeks during the growing season were found by [I. J.] Condit to be benefited in respect to size and vigor.

Studies by Van Elden lead to the conclusion that the edible forms of avocado all belong to a single species, *Persea americana*. Histological studies showed in the avocado slime ducts and lactiferous vessels typical of the Lauraceae. A study of sections of avocado tissue taken from sun blotch infected areas showed a gelatinization of the middle lamellae of the cell walls and production of brown gummy material prior to actual breaking down.

Low-headed persimmon trees with a central leader were found by Hodgson to be making the best growth and best framework. Growth continued late in these trees. A rather definite relation was established between trunk growth and short laterals near the base. The staking of young persimmon trees planted in windy locations proved beneficial.

In studies with muskmelons selections from crosses between standard varieties and those immune to powdery mildew also showed immunity, this character being apparently inherited as a simple Mendelian factor.

Viticultural work included breeding activities by F. T. Bioletti and E. B. Babcock. As determined by A. J. Winkler, working with the Muscat of Alexandria and the Molinera varieties, the position of the bud on the cane, other conditions being equal, does not influence the development of the clusters. The beneficial effects of cane pruning and flower-cluster thinning are deemed the result of better nutrition of the flower parts before and during blooming. From work with the Tokay and Malaga varieties Winkler concludes that berry thinning may be distinctly beneficial in certain vineyards where coloring is poor and where the clusters have been too compact. Early thinning was most beneficial in respect to size gain but had little influence on color or compactness.

Grading 1,100 Black Prince cuttings into various sizes according to the diameter of the uppermost node and observing rooting results, Bioletti concludes that the factor of diameter within the limits tested was of little importance with reference to rooting. The correlation between weight of cuttings and the weight of rootings was 0.201 ± 0.0157 for all grades.

Girdling at the proper stage of development was found by H. E. Jacob to be effective in increasing the set of berries, weight of cluster, and size of individual berries of seedless varieties. Earliness was not affected by girdling prior to the time the berries were one-third grown. Girdling usually resulted in very compact clusters.

Maturity studies by Winkler showed a closer correlation between palatability and degrees Balling than between palatability and acidity. The minimum Balling associated with palatability was 16.2° in Ribier and 22° in Malaga.

[Horticultural investigations at the Delaware Station] (*Delaware Sta. Bul.* 162 (1929), pp. 48-53, fig. 1).—Genetical studies conducted by L. R. Detjen and G. F. Gray with cabbage continued as a major activity (*E. S. R.*, 60, p. 736). Evidence was secured that fasciation in cabbage is evidently due to hereditary factors. Work with the Tall Saucer and Dwarf Saucer strains of cabbage indicated that no matter what the origin of the DSR the selfed progeny will contain DSR and TSR forms in varying numbers, apparently due to the presence of some lethal factor. Evidence was secured that dwarfness may not be due to a simple factor. Biennial \times annual strains gave rise to both forms but none that produced heads. Seed of wild cabbage obtained from Europe yielded a variety of types, some of which produced heads. .

Studies by Gray, C. A. McCue, and Detjen of the relative effect on peaches of nitrogen derived from different sources gave the following rating as based on six years' records: (1) Nitrate of soda plus ammonium sulfate, (2) tankage, (3) cowpeas, (4) nitrate of soda, (5) ammonium sulfate, (6) cyanamide,

(7) manure, (8) dried blood, (9) no nitrogen, and (10) no nitrogen. No differential effect of the various nitrogen sources on the time of flower bud differentiation in the Elberta peach was observed by F. S. Lagassé. The rate of development of buds in the check trees was similar to that of buds on the nitrogen trees. Buds were, however, smaller on the check trees. Following rains a lag of several days was observed to follow before the percentage of water increased in leaves and twigs. Leaves averaged 10 per cent more water than did twigs during the period June 23 to September 24. Nitrogen applied in the spring of 1926 apparently increased total nitrogen content of twigs as late as September 24 of the same year. In most cases the maximum percentage of nitrogen was attained about July 5 to 16. In all except the dried blood plat inorganic nitrogens were more potent than the organic in increasing total nitrogen content of twigs. Of various cover crops tested by Lagassé as sources of organic matter, cowpeas, soybeans, rye, and crimson clover were most efficient.

Observations by Lagassé on the rooting of cuttings of Rome, Grimes, Yellow Transparent, Delicious, and Stayman Winesap apples showed 78.4, 51.9, 27.8, 22.1, and 19.7 per cent of success, respectively. On grading the roots, it was observed that in general high percentage of rooting was accompanied by better quality.

[Horticultural investigations at the Georgia Coastal Plain Station] (*Georgia Coastal Plain Sta. Bul. 11* (1929). pp. 44-52, 56-68).—Like the preceding report (E. S. R., 60, p. 140), this is also devoted chiefly to the results of cultural and varietal tests with various fruits, nuts, and vegetables.

Fruit-thinning studies with watermelons in which one, two, three, and four melons per hill were compared with unthinned plants showed the highest production on the unthinned vines. The largest melons were produced on the one-fruit vines, but the total yields were much lower than in the controls.

[Horticultural investigations at the New York Cornell Station] (*New York Cornell Sta. Rpt. 1929*, pp. 35, 36, 56, 57, 71-73).—Studies of potassium permanganate as a stimulant in the rooting of cuttings showed very favorable results in the majority of cases, especially with softwood deciduous material. In some cases too high concentrations caused injury. The use of potassium permanganate either as a dip for cuttings or when applied directly to the rooting media is believed of commercial value. The nature of the medium was found highly important. For example, Japanese yew (*Taxus cuspidata*) rooted best in peat, while other species gave best results in a mixture of sand and peat. Varieties within a single species differed in their media requirements. Interesting differences were also secured with softwood deciduous cuttings placed in various media. In tests with cuttings of 75 varieties it was found that the position of the cut had a direct influence on the extent and location of new roots. Only 12 of the 75 varieties rooted best from cuts at the node, as compared with 38 for cuts just below.

Apple pollination studies conducted in western New York showed that with unfavorable weather conditions bees could not be counted on to carry pollen more than one or two rows from the pollinizer. Laboratory studies of the effect of sulfur dust on pollen and fruit set showed (1) that sulfur dust inhibits the growth of the pollen tube on agar media if it is in contact with or very close to the pollen grains, (2) that sulfur dust will prevent fertilization when applied to the stigma before or concurrently with pollination, and (3) that sulfur dust will not prevent fertilization if applied a day or two after pollination. Observations upon several varieties indicated that a heavy crop in the preceding year may decrease successful pollination the following season, irrespective of the

number of flowers. It was also noted that cultivation, fertilization, pruning, and water supply may have an effect on the set and development of the fruit.

Variation in response of fruit trees to pruning was found to be related to various environmental factors, such as location in the orchard, type of soil, and possibly rootstocks. Some indication was obtained that apple varieties differ in their tolerance to sod. Early plowing and cultivation for a short period was preferable to late plowing and extended cultivation.

In studies with the onion, it was found that sets more than $\frac{3}{4}$ in. in diameter produced a large percentage of seed stalks and relatively few marketable bulbs, as compared with smaller sets. Sets stored at from 32 to 40° and 70 to 80° produced few seeders, while those stored at from 40 to 50° produced a large percentage of flowering plants.

Cultural studies on Long Island substantiated results obtained at Ithaca (E. S. R., 58, p. 137)* which showed weed control to be the most important function of tillage. The use of mulching paper gave slightly increased yields of tomatoes, cabbage, beans, and potatoes but these were generally inadequate to offset increased costs. Beet yields were reduced by the mulching. Pruning and staking of tomatoes proved advantageous in certain seasons, but the higher costs of production rendered the operation of doubtful value. It was found that pruning was more likely to be profitable in wet than in dry years. Suckering of sweet corn gave no favorable results on Long Island and in certain cases reduced the yields of both corn and stover. Heavy applications of manure to asparagus gave increased but unprofitable yields, the most marked effect being obtained with nitrogenous fertilizers. Rye proved to be the most satisfactory green manure crop for most conditions on Long Island.

[Horticultural investigations at the Porto Rico Station], D. W. MAY, T. B. MCCLELLAND, R. L. DAVIS, and H. C. HENRICKSEN (*Porto Rico Sta. Rpt. 1928*, pp. 10-12, 16-18, 20, 22, 25-28, figs. 2).—In continued studies in photoperiodism (E. S. R., 60, p. 739) it was found that short day lengths apparently inhibited the normal growth of sweet corn, resulting in dwarf plants with embryonic ears.

Of root crops tested, the carrot, turnip, beet, onion, pea, lettuce, mustard, parsley, chard, kohlrabi, and certain varieties of tomatoes were grown successfully when insects were controlled. Celery thrived but lacked in quality. Cauliflower and cabbage failed to head properly, and melons required fresh soil each year.

The value of complete fertilizers for coffee was shown in higher yields on the complete nutrient plats than on those receiving nitrogen alone. The importance of potash in coffee fertilizers was shown in another series of experiments in which the potash plants surpassed the check in yield in 10 out of 11 years. On the other hand, the checks outyielded the phosphorus and nitrogen-phosphorus plats in 10 of 11 years, and the nitrogen group every year. The production of the nitrogen-potash and nitrogen-potash-phosphorus groups exceeded the checks in all 11 years. The detrimental effects of topping coffee trees are again cited (E. S. R., 59, p. 744). Borers in coffee trees were combated by injections of paradichlorobenzene dissolved in soluble pine tar oil. Excelsa coffee is recommended because of its ability to thrive under conditions unfavorable to the Arabian types.

The ripening period of pineapple plants was markedly shortened by exposure of the plants to abbreviated day lengths. The fruits of the short-day plants were materially lighter in weight and of different shape than those of the 15-hour plants, and only one fruit of the normal-day plants equaled the average

weight of the 15-hour lot. The amount of plant growth was correlated with the length of day exposure. Blossoming was retarded under the lengthened period of illumination.

Coconut palms receiving 5 lbs. of salt twice a year produced an average of 63 nuts per palm as compared with 61.9 for the checks. In a fertilizer test, check tree yields remained stationary, whereas all the fertilized palms gained in yield, especially so when a complete fertilizer was applied.

Sweet corn breeding was continued by crossing native sweet corns with vigorous selfed lines of field corn. Mayaguez-1 proved somewhat unsatisfactory in the dry districts.

Plant selection work with the pineapple showed that certain characters, such as size and vigor of the plant and size, and usually shape, of the fruit are transmitted to the progeny. A vegetative, nonfruitful type locally known as Rifon or Macho was found 100 per cent transmissible.

As indexes to maturity of pineapples, the wilting of the bract or leaflet at the base of each eye and the slight yellowing of the basal eyes were found valuable in the Red Spanish variety. As maturity approached, the color of the juice changed from a milky white to a yellow, visconsness greatly diminished, and the content of solids increased. Sugar formation ceased after the fruit was picked. Acidity, as determined by titration, ranged from less than 0.4 per cent in immature to upward of 0.9 per cent in mature fruits. Solids were usually 14 to 15 per cent in the juice of plant-ripened fruits, with the basal portion containing from 2 to 4 per cent more solids than the apex.

A temperature of from 35 to 40° F. is deemed satisfactory for shipping pineapples. Drying the stem scar, preferably in the sun, aided in eliminating black rot.

A method of determining the species of citrus rootstock is described and is based on the depth of color produced when ferric chloride is added to an aqueous solution of root tissue. Rough lemon showed practically no color, native grapefruit a color equalling 4 to 6 mg. of naringin in a 50-cc. solution, cultivated grapefruit had a variable color reaction, and sour orange a very variable reaction but nearly always equal to more than 10 mg. of naringin.

A select list of varieties of vegetables, H. L. FACKLER (*Tennessee Sta. Circ. 27* (1929), pp. 4).—An annotated list is presented of desirable vegetable varieties.

New or noteworthy fruits, X, G. H. HOWE (*New York State Sta. Bul. 578* (1929), pp. 12, pls. 4).—Commenting briefly on the pollination requirements of fruits in general, descriptions are presented in accord with previous numbers in this series (*E. S. R.*, 59, p. 233) of 12 new fruits, namely, the Carlton, Newfane, and Red McIntosh apples; the Ewart pear; the Albion and Monitor plums; the South Haven peach; the Stout Seedless and Wayne grapes; the Newburgh and Viking raspberries; and the Wyona strawberry. Of these the Carlton and Newfane apples, the Albion plum, the Stout Seedless and Wayne grapes, and the Newburgh raspberry were originated at the station incidental to general breeding studies.

Pollination of fruit trees, R. WELLINGTON, A. B. STOUT, O. EINSET, and L. M. VAN ALSTYNE (*New York State Sta. Bul. 577* (1929), pp. 54, figs. 7).—Briefly discussing the operation and the relative importance of the five main factors, namely, meteorological, pathological, nutritional, sexual, and pollination agencies, concerned in the setting of fruit, and also the practical significance of the pollination problem, the authors present data on the blooming season of important varieties of apples, pears, cherries, and plums, with a view to showing that incompatibility in time of blooming or in age of coming into bearing may interfere with pollination. It is pointed out that alternate bearers may not prove

satisfactory pollinizers for annual varieties. Ways and means of providing for pollination and the technic of determining the pollination capacities of fruits and varietal combinations are discussed. Taking up the apple, pear, cherry, plum, peach, and nectarine, specific information is presented on the pollination capacities and requirements of many well-known varieties, as determined in the extensive breeding studies at the station.

Complete pollen sterility was not found in any of the apples studied, but certain varieties—Gravenstein, Baldwin, Rhode Island, and Tompkins King—had low pollen viability. Winesap pollen when forcibly removed from the anther germinated well but otherwise remained in a compact mass.

In the case of the pears listed, all produced good pollen, but no variety was found highly self-compatible, indicating the desirability of cross-pollination.

Sweet cherries were decidedly self-incompatible and, in certain combinations, cross-incompatible. Some of the Duke varieties possessed poor pollen. The three sour cherries—English Morello, Montmorency, and Early Richmond—were strongly self-fruitful.

Some self-incompatibility was found in European plums and was very general in Japanese varieties. European×Japanese plums generally gave no fruit.

With a few exceptions, notably J. H. Hale and Mikado, peaches and nectarines were self-fruitful. A few varieties—Chill, Crosby, Early Crawford, and Tuscan Cling—were low in pollen viability.

Pollination and other factors affecting the set of fruit, with special reference to the apple, I. H. MACDANIELS and A. J. HEINICKE (*New York Cornell Sta. Bul.* 497 (1929), pp. 47, pls. 4, figs. 20).—Beginning with a discussion of the botany of the fruit blossom and the physiology of pollination and fertilization, the authors discuss, with special reference to the apple, various factors, namely, self-incompatibility, cross-fertility, pollen viability, temperature, bees, planting distances and arrangement, external and internal nutrient and water supply, etc., concerned with pollination.

McIntosh, Northern Spy, Rhode Island, Cortland, and Baldwin apples set 10, 5, 20, 5, and 95 per cent of a commercial crop, respectively, with their own pollen, as compared with 190, 165, 185, 130, and 235 per cent with Delicious pollen. Rhode Island pollinated with Rhode Island, Baldwin, Wealthy, McIntosh, Cortland, Twenty Ounce, and Delicious set 15, 20, 125, 130, 150, 165, and 185 per cent of a commercial crop, respectively. Northern Spy pollinated with Northern Spy, Wealthy, Golden Delicious, Rome, Northwestern Greening, Tolman Sweet, and Delicious set 5, 100, 110, 155, 145, 140, and 145 per cent of a commercial crop, respectively. The figures for McIntosh pollinated by self, Baldwin, Rhode Island, Cortland, Oldenburg, Twenty Ounce, Delicious, and Fameuse were 10, 50, 92, 137, 205, 175, 185, and 165 per cent, respectively.

Grown in sugar solution or on agar, Oldenburg, Delicious, Hubbardston, and Golden Delicious pollens germinated about 80 per cent, while those of Baldwin, Rhode Island, Gravenstein, and Stayman Winesap averaged only about 10 per cent, with rather weak tubes. A list of tested pollinizers arranged according to the time of blossoming is presented. That the transfer of pollen is very important was shown in a much higher set of hand-pollinated blooms than those normally exposed. The function of bees and means of improving pollination, such as top-working and introducing bouquets of bloom, are discussed. McIntosh trees supplied with bees and bouquets yielded an average of 8 bu., as compared with 2.2 bu. for the rest of the orchard. The pollination of the pear, cherry, and other fruits is discussed.

In discussing factors other than pollination concerned in fruit setting, the authors point out that inadequate nutrition, disease and insect injuries, lack of water, etc., may cause fruit to drop even after it has set. Pruning fre-

quently resulted in an increase in the amount of fruit to survive the June drop. Root defects due to poor drainage, winter injury, or faulty tillage may easily reduce the set of fruit. Sod may be injurious by creating a lack of nitrogen, as was shown in sets of 12 and 36 per cent, respectively, on the unfertilized and nitrated sides of a single tree. Ringing was effective in increasing the set of fruit, especially when combined with nitrogen treatment. Previous treatment of the orchard and the size of the preceding crop were factors concerned in setting. Strong, vigorous spurs were most productive. The number of seed was also a factor; for example, Baldwin apples abscising in the June drop averaged 3.34 seeds, as compared with 4.47 for the remaining fruit. A much larger average number of seeds in sod-grown than in tillage-grown apples is ascribed to the fact that the few-seeded apples may have fallen early in the sod orchard.

Five years' results with fertilizers in three Hudson River Valley apple orchards, H. B. TUKEY and L. C. ANDERSON (*New York State Sta. Bul. 574 (1929)*, pp. 31, figs. 7).—Studies of the value of nitrate of soda, superphosphate, and muriate of potash, alone or in combination, in (1) a young nonfruiting McIntosh orchard at Kinderhook, (2) a young bearing McIntosh orchard at Upper Red Hook, and (3) in a mature Yellow Newtown orchard at Viewmont showed marked differences in fertilizer response, depending on the age of the orchard, the character of the soil, etc. In none of the orchards was there noted any influence of superphosphate or muriate of potash, alone or in combination. In the Kinderhook orchard where the soil was kept thoroughly tilled and cover crops regularly planted, the only significant gain was an improvement in cover crop growth on the nitrogen plots. In the Upper Red Hook orchard nitrogen slightly increased the set of fruit in the on year with a corresponding decrease in the off year and slightly increased total yields, but had no effect on size or color of fruit and is described as of doubtful value. In the Viewmont orchard there was observed a striking response to nitrogen in increased growth and in heavier sets of fruit. Fruit size was, however, reduced and biennial bearing accentuated, resulting in a net loss.

In concluding, the authors point out the relatively short duration of the experiments and the possibility that future results might be in favor of fertilization.

Protecting orchard crops from diseases and insects, C. R. CROSBY, W. D. MILLS, and W. E. BLAUVELT (*New York Cornell Sta. Bul. 498 (1929)*, pp. 80, figs. 18).—With various important disease and insect pests arranged under the several host plants, namely, apple, pear, cherry, peach, plum, and quince, specific information is given on the life history of each pest and the best methods of control. A section on spray materials presents information on their composition, preparation, and uses.

Spray residues, L. R. STREETER and S. W. HAEMAN (*New York State Sta. Bul. 579 (1929)*, pp. 12).—Analyses of the arsenical residues on 94 lots of apples obtained in 1928 and 1929 from various sections of the State revealed only three lots with residues above the international tolerance of 0.01 grain of arsenious oxide per pound of fruit. The arsenic content of apples as taken from the tree and following packing showed a distinct reduction in the process of handling, namely, from an average of 0.006 grain per pound for tree fruit to 0.004 grain for packed fruit. Rainfall was found to be a factor in reducing residues.

Washing in water followed by wiping reduced residues when carefully done, but washing in dilute hydrochloric acid was more effective. Storage tests with three varieties washed in hydrochloric acid solutions of 1 to 35 and 1 to 50 by

volume showed considerably increased decay as compared with control lots in the case of McIntosh, with little or no differences in Rhode Island and Rome.

Washing fruit to remove spray residue in the Hudson Valley, E. V. SHEAR (*New York State Sta. Bul.* 575 (1929), pp. 34).—Obtaining generally unsatisfactory results with alkalis, oils, and hand wipers as removers of spray residues, various acids were tried, with results in favor of hydrochloric acid in solution. Spraying acid directly on the trees, even in drenching amounts, covered only from 80 to 90 per cent of the surface of the fruit, and in dilutions greater than 1 to 100 caused severe injury to the fruit and foliage. In the weaker strengths the sprayed acid solution was of little benefit in residue removal.

Laboratory studies showed that arsenic and fungicides containing lime may be readily removed by floating fruit in hydrochloric acid solutions. Sulfur and oil spray residues were less easily removed. The cleansing action of acid was lessened by low temperature, wax, oil, and dirt. Wind-blown dust from cultivated fields, roads, or cement factories was difficult to remove. No treatment was found adequate to remove sooty fungus or black mold. Waxy varieties were difficult to clean and required prompt washing after picking. Rinsing of acid-washed fruit was highly essential, there being a marked tendency for unrinsed fruit to decay rapidly in storage. Washed and rinsed fruit, on the contrary, kept as well or better than controls. Rain was found an important factor in reducing spray residues and in normal seasons with moderate spraying in the late portion sufficed to remove most of the toxic residues.

In conclusion, the author suggests that acid solutions of 1 to 100 to 1 to 500 will prove generally suitable for cleaning fruit. One minute or less was sufficient in the acid bath. Loss of acidity in the bath necessitated frequent measurement and replenishment.

Cane versus spur pruning for grapes, C. C. WIGGANS (*Nebraska Sta. Bul.* 237 (1929), pp. 30, figs. 8).—Based on a study of records taken on cane-pruned and spur-pruned Concord and Moore Early grapes from 1922 to 1928, inclusive, the author concludes that cane pruning is the more satisfactory practice. No significant differences were found in the percentage of fruitful buds, but cane-pruned vines bore somewhat larger and more numerous clusters, accounting for an average increased yield of about 400 lbs. per acre. Cluster weights averaged 65.7 and 62.9 gm., respectively, for cane-pruned and spur-pruned Concorde and 53.2 and 51.5 gm. for Moore Early. The most productive bud on Concord canes was No. 7 and on Moore Early cane No. 10. In the case of the three-bud spurs the middle bud was the most productive. No significant differences were noted between the yields of single- and double-trunk plants. Alternation of spur and cane pruning on the same plant produced no appreciable effects on yield. The largest leaf area was found at bud 3, with gradual decrease from there outward.

Determinations of moisture, sugar, starch, and protein in the several buds of cane-pruned vines showed no material differences that could account for the differences in production. Much more old wood was accumulated on spur-pruned than cane-pruned vines. Correct spur pruning is conceded more difficult than cane pruning and hence less desirable as a general practice.

FORESTRY

[**Forestry investigations at the California Station**] (*California Sta. Rpt.* 1929, pp. 74-78).—Planting in the redwood region is deemed a wrong practice, and it is believed that restocking should be provided for by leaving a reasonable number of the smaller or unmerchantable trees. Trees under 26 in. in diameter

yielded less than 5 per cent of the output, and their lumbering was expensive. An unnecessarily high percentage, more than 50 per cent, of the potential merchantable lumber was lost during logging and milling.

Special painting schedules were devised for preventing discoloration of painted surfaces on sugar pine interior trim. It is believed that the resin in the resin ducts in the heartwood is altered so that it reacts differently from the resin of sapwood. Shellac in the ground coat or the use of cellulose paints proved most effective, although an aluminum bronze primer was nearly as good.

To study the effect of Eastern climate a test chamber was constructed in which high and low temperatures could be induced at will. Discoloration of redwood siding was found due to the leaching out of coloring matter from the back of the siding by waters of condensation, which, charged with coloring matter in solution, passed between the pieces and trickled down the outside, leaving brown streaks upon evaporation. Painting all the surface of the siding proved a remedy. Stannous chloride on the back of the siding was not successful, and new designs were studied with a view to preventing the movement of moisture.

Compression wood was found to occur commonly in redwood and was almost invariably associated with a spirally furrowed bark and wood of the interlocked grain type. Compression wood occurred as crescent-shaped areas in the stump section and materially interfered with sawing. Bark volume of redwood amounted to 20 cords per acre.

Termites interfered with durability tests of wood in the form of stakes in the soil. Surface protective treatments were useless, and marked variability was noted in the durability of individual samples within a species. Port Orford cedar and the yellow type of bald cypress were below expected durability.

Cytological studies showed rapid tissue changes in the stems of coniferous seedlings. These changes are believed associated with resistance to various climatic phenomena. Species differed in their resistance to high insolation. Damage always occurred within a limited area at ground level, a region protected by the shade of the cotyledons. Stem structure was also a factor in resistance. No essential difference was found in the resistance of protoplasm in various species, coagulation of proteins taking place within a minute or two at a temperature around 130° F. The reaction was greatly slowed down at 10° C. lower.

Records of the growth of Douglas fir indicated that in California this species grows faster when young and reaches a culmination of mean annual growth earlier than in Washington and Oregon.

Forest plantations at Biltmore, North Carolina, F. W. HAASIS (*U. S. Dept. Agr., Misc. Pub. 61 (1930), pp. 30, pls. 11, fig. 1*).—Beginning in 1890 and continuing until about 1911 large plantings, both of mixed and pure stands, were made on the private Biltmore estate. Many different species and species combinations were tried, the failure or success of which, as recorded in this paper, affords an excellent object lesson. Based on the results of various surveys and studies by the Forest Service and on information supplied by the owner, this paper summarizes the outstanding results.

In general, the native pines, shortleaf and pitch, and the northern pine, *Pinus strobus*, have proved the most successful of the conifers, and, as a matter of fact, of all species. Fair growth of Douglas fir and Norway spruce was obtained on favorable sites. Of hardwoods, sugar maple proved best for planting, with oaks second. When planted with pine, oaks and other hardwoods made poor growth, but the oaks persisted, apparently always ready to replace the conifers.

Certain forestry practices are considered in the light of results at Biltmore. The replanting of old fields with a species which thrives in the virgin forests

of that region may fail because of the changes in soil and environment resulting from the removal of the forest and the subsequent farming operations. Close planting was not successful unless followed by systematic thinning when required.

Ohio Forest News, [June, 1928–September, 1929] (*Ohio Forest News* [Ohio Sta.], 1928, Nos. 1, pp. 8; 2, pp. 8, figs. 2; 3, pp. 8, figs. 3; 1929, Nos. 4, pp. 8; 5, pp. 8; 6, pp. 8, fig. 1; 7, pp. 8, fig. 1).—These pamphlets contain popular information in regard to the various State forests and forest parks and miscellaneous forest activities.

Pocket guide to Alaska trees, R. F. TAYLOR (*U. S. Dept. Agr., Misc. Pub. 55* (1929), pp. [1]+39, pl. 1, figs. 28).—Supplemented by a map showing the distribution of the most important species, descriptions are presented of the tree, leaves, bark, and wood of 28 species, with drawings to aid in identification. A key is also given.

Quaking aspen: A study in applied forest pathology, E. P. MEINECKE (*U. S. Dept. Agr., Tech. Bul. 155* (1929), pp. 34, pls. 2, figs. 5).—Quaking aspen (*Populus tremuloides*), a species covering large areas of the national forests in Utah and described as of potential value as a source of pulp wood, is reported as being highly susceptible to a number of diseases which cut down the merchantable output, especially in the older age classes. Studies on a representative area in the Wasatch Range, site quality I-II and ages from 30 to 130 years, showed a general cull of 21 per cent, largely caused by *Fomes ignarius*, false tinder fungus, a widely distributed parasite. The percentage of merchantable volume loss as culls ranged from 1.45 per cent in a 30–40-year stand to a maximum of 44.75 per cent in a 121–130-year stand. The sharp increase in cull percentage occurred in the 91–100-year class. On a basis of net volume production and net increment, both the pathological felling age and the pathological rotation lie at about 80 to 90 years. Pulp production from aspen is deemed economically feasible in the intermountain district, since silvicultural rotation is apparently shorter than the pathological.

. Fire scars were found to be an important source of infection, the total cull from decay traceable to this source amounting to 68 per cent of the total loss from gross cull.

Investigations in weed control by zinc sulphate and other chemicals at the Savenac Forest nursery, W. G. WAHLENBERG (*U. S. Dept. Agr., Tech. Bul. 156* (1930), pp. 36, pls. 7, figs. 3).—At the Savenac Forest nursery in western Montana an application immediately after sowing the seed of 8 gm. of zinc sulfate dissolved in 250 cc. of water to each square foot of soil proved highly effective in controlling the three most troublesome weed species, namely, sorrel, timothy, and clover. In slightly larger amounts, 10 gm., zinc sulfate caused injury to the growing tips of the forest tree seedlings. New but materially reduced applications were needed for each successive crop of trees, and organic fertilizers reduced the efficiency of the treatments about 20 per cent.

Zinc sulfate exhibited an apparently beneficial influence on the germination of pine seeds, both in reducing the time required to complete germination and by increasing total germination. The author believes that this result is due to the control of parasites rather than to any direct effect. On checking the behavior of the treated western white and western yellow pine stock through six years, no detrimental effects were observed. The germination of western red cedar was apparently reduced by zinc sulfate treatment. Where treatment was given in the transplant bed some injury to trees was noted. Field peas were grown successfully as green manure on zinc-treated soil.

An increase in soil acidity and the accumulation of zinc in injurious quantities are deemed potential hazards from the treatment, yet determinations made

by the Forest Products Laboratory at Madison, Wis., failed to show any trace of soluble zinc in soil treated two years previously. Small quantities of insoluble zinc were found, however, and the occurrence of injury on a second crop of trees to which the full zinc sulfate application was given is believed the result of a change of the residual insoluble zinc to a soluble form.

DISEASES OF PLANTS

[Plant pathology at the California Station] (*California Sta. Rpt. 1929*, pp. 38, 39-44, 45, 57, 87-91, 93, 105).—Notes are given of a number of diseases that have been under observation during the year.

A disease of the walnut, commonly known as yellows or rosette, was successfully overcome by small applications of copper sulfate. The perfect stage of the fungus *Phomopsis californica* was found to be a Diaporthe embedded in the surface of dead pieces of bark. Some indication was obtained that sulfur spraying and dusting prevent the splitting of navel oranges and hasten their coloring. A yeastlike fungus (*Nematospora coryli*) carried by the puncture bug was discovered in citrus and pomegranate fruits and in cotton bolls. Histological studies of the tissues invaded by *Penicillium italicum* and *P. digitatum* showed mycelia close up to the visibly affected margin of the lesions. A species of *Aspergillus* was found capable of killing mealybugs in a few days under favorable climatic conditions. Carbon disulfide was successfully employed in killing *Armillaria* on orange roots. A spot similar to the peteca on lemons was developed by injections of small amounts of orange and lemon oils and of geraniol. Red blotch of lemons was simulated by touching green fruits with various amyl compounds and ethyl acetate. Studies of avocado diseases indicated that part of fruit troubles originate from abrasion. Inoculation tests with the walnut crown rot organism (*Phytophthora* sp.) showed all Juglans species to be more or less susceptible, and that the disease may cause death unless cankers are cleaned. Fruit beetles and vinegar flies were found to be important carriers of yeast and bacteria involved in the rotting of harvested fruits. A disease of the *Washingtonia filifera* palm was found in the trunk rather than in the top, as commonly believed. Various dusts were tested as controls for powdery mildew of cantaloupes.

Tank experiments with walnut trees showed that the continued use of saline irrigation water reduces the size of the leaves, with occasional burns. In good soil the ash content of the dry matter reached its minimum in the rootlets. Salinity not only affected the inorganic constituents of the trunk, shoots, and leaves but also those of the husk and kernel. Salinity reduced rather than increased the ash content of the aboveground portions. Direct insolation increased the ash content of the dry matter. A progressive increase in the total phosphorus of walnut kernels accompanied growth. The amount of each inorganic constituent of the ash of the kernels also increased.

Boron in minute quantities was found to be essential to the citrus plant, its complete absence resulting in pronounced symptoms of decline. Evidence was also secured of the toxicity of boron. When used with nitrate of soda it intensified the mottling of Valencia oranges. Citrus and walnut leaves affected by boron contained reduced amounts of calcium and increased amounts of potassium.

Mottle leaf of citrus was produced artificially by the use of lithium. Large concentrations of calcium in the tracheal sap of mottled trees, despite a shortage in the leaves, are tentatively ascribed to the inability of the mottled leaves to utilize this material.

The magnesium content of the dry matter of avocado leaves was from two to three times that of citrus leaves. Tipburn of avocado leaves was found to be associated with a high chloride or sulfate content.

Transpiration studies with citrus showed the older leaves to transpire faster than the young leaves, and that in some cases approximately one-half of the water escapes through the upper surface. Although spray oils readily passed into the leaf tissues and in some cases migrated to the twigs, the tree was apparently able to decompose the oil before it advanced further.

Disease resistance studies conducted by F. N. Briggs showed Banner Berkeley wheat to possess one dominant factor for resistance to bunt. Turkey wheat C. I. 1558 and Crimean wheat C. I. 3055 were found to possess single factors for bunt resistance. Inoculation tests with *Ustilago hordei* on barley, in which several physiologic strains of the disease were used, showed that varieties resistant to one strain were similarly resistant to the others. Ceresah was not as effective as copper carbonate for controlling bunt.

Cytological studies of heterothallism in cereal rusts were continued by R. F. Allen.

Spraying walnut trees in the catkin stage with Bordeaux mixture considerably reduced the amount of blight. Brown rot, green rot, and shot hole fungi accounted, respectively, for the prevailing twig and blossom blight, shot hole of leaves, and dropping of leaves and fruit of the almond.

Sour sap and gummosis of stone fruits were found of bacterial origin.

Work upon green rot of the apricot showed that sporulation occurs much earlier and with much less dependence upon the weather than had been previously recognized.

Cherry trees on mahaleb roots were much freer from buckskin disease than those on mazzard roots. Insects were found to be almost wholly responsible for the transmission of fig diseases.

Sulfur was found to be of no value as a fungicide for downy mildew of lettuce. Yellows of kale was found to be identical with cabbage yellows, and some progress was made in the selection of resistant strains. Certain blackeye bean strains were found to be resistant to *Fusarium* root rot.

The method perfected by J. P. Bennett of treating chlorotic pear trees by the injection of powdered iron salt into the trunk was successfully utilized on a commercial scale. Good results were also secured with chlorotic peach, plum, prune, apricot, and walnut trees.

Studies in potato dormancy showed that certain rest-breaking treatments, such as ethylene chlorhydrin, increase permeability to carbon dioxide and oxygen. The degree of permeability to these gases decreased in storage. Respiration rate declined with the maturity of the tubers in the soil and in storage at 25° C. The White Rose potato had a higher respiratory activity and a shorter rest period than did the Irish Cobbler.

[Report of the] department of plant pathology (*Delaware Sta. Bul. 162* (1929), pp. 53-67).—Zinc sulfate and aluminum sulfate, tested by T. F. Manns as colorless sprays for the Delaware grape, gave equally as good control at a considerably lower cost than did neutral copper acetate.

Cooperative studies conducted by Manns and O. C. Boyd of the Georgia State Board of Agriculture upon tomato seedlings raised in Georgia from seed obtained from 40-odd commercial sources and shipped to New Jersey and Delaware for growing suggested that much of the trouble prevalent on southern-grown tomato plants is due to injuries in transit. The disinfection of tomato seed with bichloride of mercury or organic mercury dust did not control or prevent outbreaks of leaf and stem blight caused by *Macrosporium solani* and

M. tomato. The methods employed in handling southern-grown plants before planting were also a factor in survival.

The disinfection of tomato seed with Ceresan at the rate of 6 oz. per bushel of seed markedly increased the stand, but early blight was equally as severe on the treated as on the untreated lot.

The leafhopper, the tarnished plant bug, the peach curculio, and the black peach aphid were tested as possible carriers of peach yellows without results. Formaldehyde solution (1 lb. in 25 gal.) applied at the rate of $\frac{1}{2}$ gal. per square foot proved a highly effective control for black rot on the sweetpotato seed bed. However, when selected roots were used and were treated with bichloride of mercury, the new soil yielded clean plants, which in the field yielded the largest crops.

Results of direct inoculations by J. F. Adams on the sterile sweetpotato flesh with various species of *Actinomyces* failed to show identical results, except with *Actinomyces p.* and *A. scabies* (isolated by Manns). Cultural studies on three different media gave no evidence of positive cultural differentiation.

A comparison by Adams of several disinfectant treatments for soybean seed gave negative results as regards the control of seed-borne foliage diseases. Four distinct leaf or foliage diseases were identified. Watering soybeans in the greenhouse with an inoculum of old leaves that showed heavy infection failed to cause infection.

Studies by Adams of bacterial spot of peach indicated that this disease is not carried through the seed, nor was the organism transferred by overwintered diseased leaves. Cankers to a maximum of 50 to a tree were found on 7-year-old Elbertas which had been diseased for 3 years. Cultures from cankers collected during October, November, January, March, and May gave positive infections on living wood. Cultures from dead and living diseased twigs collected November 15 gave 33 and 50 per cent, respectively, of plates showing positive growth. Some indication was obtained that the organism was more abundant in the wood above than below the lesion. Tests of zinc sulfate alone or combined with hydrated lime showed higher toxicity in zinc sulfate alone, probably because of higher acidity. No influence as denoted by growth was evidenced from applying copper sulfate to the soil.

Pouring a decoction of dead infected cucumber and cantaloupe leaves over young melon and squash plants in the greenhouse failed to produce infection of downy mildew or leaf blight.

Colloidal copper paste, 2 lbs. per 50 gal. of water, was tested for the control of fruit spot and reduced the percentage of heavy infection as compared with lime sulfur. Compared with Bordeaux mixture for the control of bitter rot on King David apples, colloidal copper was the less effective. Laboratory tests showed greater suspension and spreading qualities in Bordeaux mixture to which 0.5 per cent of Penetrol had been added. Penetrol also gave good results in lead arsenate spray and was completely compatible with lime sulfur, zinc sulfate, and other materials. Some slight benefit was obtained from disinfectants for the control of wheat smut. A species of *Actinomyces* was found on the roots of cannas making unsatisfactory growth.

Plant pathology [at the New York Cornell Station] (New York Cornell Sta. Rpt. 1929, pp. 48-50).—Root and crown injury of large fruit trees was found to be due primarily to freezing injury, the rôle of the fungi present on dead and dying roots being largely secondary.

Outbreaks of apple rust in the Hudson River Valley in 1927 and 1928 led to a study which revealed three distinct rust diseases, all of which were best controlled by the eradication of red cedars with the application of fungicides offering some promise of control of fruit infection.

The roguing of diseased potato fields and the indexing of seed stock were found useful means in reducing the percentage of disease.

Report of the plant pathologist, C. M. TUCKER (*Porto Rico Sta. Rpt. 1928 pp. 29-35, figs. 3*).—Continuing investigations (E. S. R., 60, p. 746) on the avocado root disease, which attacks trees of all ages from young seedlings to large bearing specimens, cultures were made of roots of six infected trees, and five yielded a *Phytophthora* closely resembling *P. cinnamomi* morphologically but apparently differing in pathogenicity. Inoculation experiments demonstrated the ability of the fungus to kill avocado roots, the process requiring approximately five months, during which time practically all the roots had rotted. The disease occurs frequently in heavy and poorly drained soils, and infection and rotting take place mostly during the rainy season.

Seedlings of the Duncan×Triumph grapefruit were as susceptible to citrus scab as the susceptible Duncan parent, and observations on second-generation seedlings showed scab lesions on the leaves and young stems of some of the plants.

Phytophthora infections were found on pepper plants and also on fallen grapefruit which had been on the ground for several days. Grapefruit on the tree was not infected, leading to the suggestion that the soil is likely the usual habitat of the fungus.

In describing the symptoms of the pokkah boeng disease of sugarcane, the author states that they agreed in certain respects with those reported from Java and Cuba. The effects of the disease on production are not yet established. Isolations from reddish discolored tissue of chlorotic spots yielded two *Fusarium* strains in about equal quantities, but in other cases no fusaria were found, nor was the disease reproduced by inoculation. Efforts to transmit the disease by planting cuttings from diseased stalks were unsuccessful.

Temperature and soil-moisture relations of *Fusarium oxysporum* var. *medicaginis*, J. L. WEIMER (*Jour. Agr. Research [U. S.]*, 40 (1930), No. 2, pp. 97-103, figs. 4).—Studies of the response to temperature when growing in pure culture and of the influence of soil temperature and moisture on infection showed no reason why the alfalfa wilt-causing organism under study, so far found only in northeastern Mississippi, can not, as far as its cardinal temperature requirements are concerned, occur throughout a much wider range. The optimum temperature for mycelial growth in pure culture was near 25° C. (77° F.) and the maximum about 37 or 38°. The minimum was undetermined but lay somewhere below 3°. The optimum for infection concurred with that for mycelial growth. The Kansas common, Grimm, and hairy Peruvian varieties proved susceptible.

Alfalfa root injuries resulting from freezing, J. L. WEIMER (*Jour. Agr. Research [U. S.]*, 40 (1930), No. 2, pp. 121-143, figs. 10).—Observations on young Kansas common and Grimm alfalfa plants frozen artificially in the laboratory and naturally in the field confirmed the belief that the cracked and decaying conditions of the crown and upper part of the taproot are the result of freezing. Designating as phloem injury and heart rot the injuries to the tissues lying outside and inside the cambium layer, respectively, the two types are discussed. Both injuries developed in potted plants frozen at -6.6, -8.2, and -11.6° C. for 5, 7, and 4 hours, respectively. Phloem injury alone was evident in plants frozen at -11.6, -13.8, -14.5, -17, -21, and -21° for 3, 6, 7, 4, 2, and 3 hours, respectively. Phloem injury, heart rot, or both became evident in 6.9 per cent of the young plants frozen in soil for 40 days or less. No typical phloem injury or heart rot was produced in plants frozen artificially in the field in summer.

Histological studies of the frozen roots showed a splitting apart of cells, especially along the rays. Microorganisms commonly associated with typical winter injury are considered for the most part saprophytes or at the best very weak parasites. Inoculation with 5 species of *Fusarium* and 3 of bacteria isolated from typical heart rot and phloem injuries failed to infect unfrozen plants. In the case of moderate injury the splitting wounds apparently heal during the subsequent growing season.

Studies of the black-rot or blight disease of cauliflower, E. E. CLAYTON (*New York State Sta. Bul.* 576 (1929), pp. 44. figs. 11).—Based on the results of seven years' study on Long Island, the author asserts that excellent control of black rot of cauliflower, caused by *Bacterium campestris*, may be secured by locating the seed beds on disease-free soil and by the use of seed that has been treated in hot water for 18 minutes at 122° F. (E. S. R., 59, p. 50). Depending on the moisture conditions, black rot may appear either as a dry blight or a wilt. The infections occur over the entire leaf instead of along the margins as in cabbage. Outbreaks are to be expected when the night temperatures are well above 50°. Rain greatly accelerates the rate of spread and the severity of the attack. Cauliflower seed pods were found highly susceptible, and the seed contained therein matured normally but was generally infected.

Seed-bed infections are considered the basis of destructive field outbreaks, since in later infections the disease fails to become widely distributed before the arrival of inhibiting cool autumn weather. Insects were not found responsible for field outbreaks, rain and laborers being deemed the important agencies of field spread. Bordeaux mixture, fertilizers, and hand picking and destruction of diseased plant material were not effective controls. Some evidence was obtained that resistant varieties may be developed.

Field tests with treated seed corn, T. A. KIESSELBACH (*Jour. Agr. Research* [U. S.], 40 (1930), No. 2, pp. 169-189).—Of four commercial mercuric seed-corn treatments tested at the Nebraska Experiment Station, none gave any significantly beneficial effect upon such characters as stand, vigor and size of growth, time of maturity, percentages of smutty, barren, lodged, broken, or diseased plants, percentage of diseased ears, shrinkage and shelling percentage of the ear corn, and yield of grain per acre. When *Diplodia*-infected seed was planted the field stand was decreased about 35 per cent but there was no material influence on growth, the proportion of diseased plants, or on yield, this actually being 1.8 bu. per acre larger with the diseased seed, due to the advantage of the thinned stand. The beneficial effects of seed treatment were apparently limited to the germination and seedling stages, the general results leading to the suggestion that Nebraska seed corn, selected on the basis of sound and mold-free appearance, is generally not appreciably benefited by treatment with mercuric compounds.

Seed potato treatment tests for control of scab and Rhizoctonia, R. W. Goss and H. O. WERNER (*Nebraska Sta. Research Bul.* 44 (1929), pp. 42. fig. 1).—Comparing hot formaldehyde, corrosive sublimate, and a number of commercial organic mercury preparations as treatments for *Rhizoctonia*-infected and scab-infected seed potatoes, the authors found that hot formaldehyde was by far the best treatment for scab and was also best for *Rhizoctonia*. Corrosive sublimate failed to control scab and was not equal to formaldehyde for *Rhizoctonia*. Organic mercury compounds applied as dips or as dusts to cut and uncut seed failed to reduce scab consistently and were less effective than corrosive sublimate against *Rhizoctonia*. Sulfur applied to the soil decreased scab one year but not the previous. Treating apparently clean tubers of Bliss Triumph with hot formaldehyde decreased the amount of scab in the resulting crop. Hot formaldehyde treatment delayed sprouting in Early Ohio in two of the three

years, and if sprouting was followed by hot, dry weather the crop was decreased. Such injury was not observed in nine scab tests with Triumphs and Irish Cobblers. Organic mercury injured cut seed pieces unless they were dried rapidly after treatment. Organic mercury did not increase yields other than by the actual control of Rhizoctonia.

In concluding, the authors point out that the value of the treatments is diminished on heavily infected soils, but because of the small cost and high efficiency of the hot formaldehyde treatment they recommend its use as an universal practice.

Experiments with blister canker of apple trees, H. W. ANDERSON (*Illinois Sta. Bul. 340* (1930), pp. 53-90, figs. 16).—Widely distributed and occurring on a number of native plants, as well as the apple, blister canker (*Nummularia discreta*), the life history of which is discussed, constitutes a serious menace to certain susceptible apple varieties, such as Ben Davis and Gano. Attempts to inoculate old and new pruning wounds, even under conditions highly favorable to infection, generally gave negative results, it being apparent that most orchard infections are in the ragged wounds resulting from broken limbs, especially in the tops of the trees. Cankers about pruning wounds were not necessarily of local origin but were in most cases produced by the outward growth of mycelia from the heartwood or older xylem tissue. Infection was rare on trees less than 15 years old, due chiefly to the absence of broken branches. Invading the wood, the fungus grows downward at varying rates of speed through the woody cylinder and outward through the lateral branches, often making substantial progress before appearing on the surface. Physical factors, such as soil type, location of the orchard, and amount of rainfall, were not found to be associated with the prevalence of the disease, but there was some evidence of a relation between prevalence and drainage.

Concerning control, the only satisfactory method is said to consist in the elimination of the spore-bearing cankers by the cutting out of all diseased tissue down to the wood and back to the healthy bark at the edges, followed by sponging with a mercury disinfectant. The success of the treatment depends on complete elimination of spore-bearing surfaces. Various managemental practices, such as selection of site, careful pruning, and frequent inspection of trees for cankers, which contribute to control, are discussed.

Physiological dropping of fruits in Delaware, L. R. DETJEN and G. F. GRAY (*Delaware Sta. Bul. 162* (1929), pp. 43-48).—Records taken upon the time and nature of the dropping of flowers and immature fruits in the Carman and Elberta peaches showed comparable behavior until May 14. Beginning from this date, there was in the Carman variety a distinct cessation of shedding for one week, while in Elberta shedding was resumed immediately, reaching a peak six days sooner than in Carman. Unlike the Lola variety in previous years, neither Elberta nor Carman shed any unopened fruit buds. It is pointed out that cold, wet weather may affect the phenomena of dropping by interference with pollination.

Studies with the Bing cherry showed a tremendous loss of fruit buds from April 15 to May 20, due apparently to winter injury. The rate of shedding closely followed that of normal fruits. A bacterial blight of the flowers also caused much shedding, the diseased fruits dropping at about the same time and at the same rate as the fruit buds. Abscission was apparently in two waves, a large one, April 22 to May 27, and a small one, May 28 to June 4. Varieties of cherries apparently differed in their habits of dropping.

Abscission of undeveloped apple blossoms was observed to begin while the tree was yet in bloom and to continue for only a short period. Observations on the dropping of Yellow Transparent and Stayman Winesap flowers, prevented from pollination by the removal of stamens and bagging in one case and the removal of pistils in the other, showed these unpollinated flowers to all drop before the crest of the initial abscission wave was reached, the bulk dropping being at the very beginning of the upward grade. The bagged blooms were shed slightly earlier than the uncovered, due, in the author's belief, to the injurious effects of shading. Diameter and volume measurements taken on 150 Stayman Winesap fruits showed a perceptible increase in part of the fruits about the time the first ones were being shed. Part of these ceased growing almost immediately and dropped in a week or two. The remainder continued to grow rapidly until about June 1, when a resting period was reached for part of the fruit followed shortly by dropping. Later other fruits ceased growth and dropped, but always in decreasing numbers.

Comparing the behavior of early and late ripening apples, it was noted that both groups had two distinct waves of dropping, but that the early varieties seemed to begin their June drop a little earlier, tending to cause the two drop waves to overlap.

A physiological method of distinguishing *Cronartium ribicola* and *C. occidentale* in the uredinial stages. G. G. HAHN (*Jour. Agr. Research* [U. S.], 40 (1930), No. 2, pp. 105-120, figs. 3).—Seeking to establish physiological differences between the white pine and piñon blister rusts, which are morphologically very similar in their uredinial and telial stages, various foreign *Ribes* species and horticultural varieties were inoculated with a number of strains of both rusts. Of 48 garden currant varieties inoculated with white pine blister rust, 45 proved susceptible. Of 41 varieties inoculated with piñon blister rust, only 4 were infected, and these to a negligible degree. Fay Prolific proved an especially satisfactory differential host. Three varieties, Franco-German, Holland, and Victoria, were immune to both species of rust. *R. nigrum* developed only scant infection with piñon blister rust, the Champion variety being most susceptible and Blacksmith and Boskoop Giant immune. Of 12 foreign *Ribes* species tested, only 2, *R. tenue* and *R. fasciculatum*, were susceptible to white pine blister rust and immune to piñon blister rust. No reliable tests for differentiating the two rust species in the telial stage were established, although trained observers could detect differences.

ECONOMIC ZOOLOGY—ENTOMOLOGY

The habits and economic importance of alligators. R. KELLOGG (*U. S. Dept. Agr., Tech. Bul.* 147 (1929), pp. 36, pls. 2, figs. 2).—Following a brief introduction, the subject is considered under the headings of geographic distribution and habits, alligator hunting, alligator reserves and farms, and food of the alligator.

The food of the alligator is said to be "made up chiefly of crustaceans (47 per cent), fishes, turtles, and other vertebrates (29 per cent), and insects and spiders (23 per cent), consisting for the most part of crabs, crawfishes, fishes, turtles, and water beetles. It does not appear that they are seriously destructive of useful forms of wild life, as muskrats and turtles, and important food fishes do not bulk large in their diet. Their depredations on crabs and shrimps are not sufficient at present to cause fishermen any difficulty in meeting the market requirements. The insects they consume mostly are economically unimportant, and any influence they may have on the control of objectionable species of animals and plants is for the most part negligible. They undoubt-

edly are beneficial, however, in feeding upon the voracious alligator gars, which destroy food fishes, and crawfishes, which are burrowing pests of agriculture.

"Alligators individually are as valuable as other forms of wild life in general, especially to unreclaimed southern marshlands for the commercial value of their hides. Measures should be taken wherever possible to insure their continued existence as an interesting species, in numbers sufficient for their perpetuation, consistent with reasonable utilization and any necessary control."

A list of 41 references to the literature is included.

Surinam toad, D. W. MAY (*Porto Rico Sta. Rpt. 1928, p. 7*).—The giant toad (*Bufo marinus*), which was introduced into Porto Rico some five years previously, has greatly increased in numbers and is being shipped to all parts of the island in lots of from 10 to 1,000. Reports indicate that the toads are effective in controlling the changa, or mole cricket, the worst insect pest on the island.

Pheasants, D. W. MAY (*Porto Rico Sta. Rpt. 1928, p. 12*).—A brief reference is made to the release of ring-necked pheasants which had been reared from eggs received from the United States. The experimental work thus far conducted indicates that pheasants can be successfully raised on the island.

[Report of work in entomology and parasitology at the California Experiment Station] (*California Sta. Rpt. 1929, pp. 33, 34, 68-74, 114*).—A brief account is given of work under way at the Citrus Experiment Station with oil sprays for citrus trees, with the walnut husk fly, etc. Water washing for mealybugs was continued energetically and considerable information secured on the value of this treatment supplementary to the work of the *Cryptolaemus* predator. Reporting further upon the establishment of several new natural enemies of the citrophilus mealybug (*E. S. R.*, 62, pp. 547, 757), it is stated that the internal parasite *Coccophagus gurneyi* gives excellent promise of holding the mealybug in check, since in some orchards it is already destroying nearly 100 per cent of its host.

In continuing experimental work with artificial light in the orchard as related to its effect on the egg-laying habits of the codling moth, six 500-watt lights were suspended by W. B. Herms, A. D. Borden, and B. D. Moses directly over a block of 15 apple trees consisting of several varieties, and this plat was flooded with light each evening for from 2.5 to 3 hours from April 26 to June 30 (the end of the first brood of moths). In comparing the fruits of the same variety, namely, Skinner Pippin, at the end of the test it was found that 21 per cent of the apples on check trees outside of the test plat were moth attacked while only 14.5 per cent of the apples inside the test plat were so affected. This work, the details of which for 1928 have been reported by Herms (*E. S. R.*, 61, p. 251), was being continued more extensively in 1929.

In a study of the *Hippelates pusio* Loew fly problem in the Coachella Valley, Herms and R. E. Burgess discovered the hitherto unknown stages.

Control of mealybugs by use of various so-called highly refined summer oil sprays was continued by E. O. Essig, who found them most satisfactory for general use. On tender ornamentals from two to four applications of 1 or 2 per cent oil sprays caused no injury and gave good control.

Observations of the life history of the snowy tree cricket were continued by Smith (*E. S. R.*, 61, p. 351) in the Santa Clara Valley, raspberry patches dusted the preceding year commercially with sodium fluosilicate having been free from crickets. The application of a 70 per cent sodium fluosilicate dust at the rate of 50 lbs per acre was found most effective.

Reference is made to a study of the life history and control of the mealy plum aphid commenced by Essig and L. M. Smith in 1928. This species overwinters in the egg stage on the trees, passing from 5 to 9 wingless parthenogenetic generations on the plums in the spring. During June winged parthenogenetic females are produced which fly to cattails and reed grass, and a number of wingless parthenogenetic generations follow on these plants. During November winged parthenogenetic females arise which fly to the plums and give birth to the sexual females. Winged males later occur on the summer hosts and fly to the plums, where mating and oviposition occur. Dormant oils used against the egg gave on the average a 30 per cent control. Spring and fall sprays of summer oil and combinations of summer oil with whale oil soap and nicotine gave much promise and will be studied further.

In apple insect investigations continued during the past year by Borden (E. S. R., 61, p. 351), both in the Sebastopol and Watsonville districts, the practical value of the bait trap as a means of determining the proper time of spray applications for codling moth was demonstrated.

Almost a complete control was obtained by Borden of the willow weevil (*Stamoderes uniformis*), which caused considerable damage to very young apples as well as foliage the preceding year in a limited area near Sebastopol. This control was obtained on a 20-acre experimental plat through the use as a bait of willow twigs treated with Paris green and placed at the base of each tree, also banded with tanglefoot.

The Rickettsia-like microorganism present in the infective beet leafhopper was cultivated by Severin, A. J. Salle, and Swezy (E. S. R., 61, p. 352) in a number of culture media under partial anaerobic and aerobic conditions. The filtrate obtained from the feces of infective beet leafhoppers as well as from beet roots infected with curly top usually became turbid in two or three days and contained the Rickettsia-like microorganisms. That from beet leafhoppers macerated in equal parts of steam extracted beet root juice and beet sugar 5 per cent, to which hypophysis was added, after centrifuging for one hour became turbid in about a week. H. H. Severin has found that the thermal death point of the curly top virus in the beet leafhopper lies between 70 and 75° C.

O. H. Lovell found in observations in the San Jose Valley that there is only one generation of the vegetable weevil during the active season of the weevil from September to mid-June. For control a mixture of 70 per cent sodium fluosilicate and 30 per cent diatomaceous earth was used with good success on carrots, producing only a slight burn.

The cooperative work conducted with the pepper weevil by Davis with the U. S. D. A. Bureau of Entomology was continued (E. S. R., 61, p. 351). This weevil occurs quite commonly in the infested part of the State, nightshade having been shown to be an alternate host upon which it is able to pass the winter and sometimes to complete a generation or more before the peppers reach sufficient size to be attacked. Observations indicate that the weevils do not hibernate in southern California under normal conditions, and that they can breed only in the buds and pods of pepper and in the berries of nightshade.

Further observations by Lamiman on *Tetranychus pacificus* McG. (E. S. R., 61, p. 351) indicate that it is responsible for most of the injury attributed to *T. telarius* L. in the deciduous orchards of the interior valleys of the State. The most serious injury by this mite was brought to attention late in the summer of 1928 when it was found attacking grapes in the San Joaquin Valley, particularly those suffering from lack of moisture.

Reference is made to the discovery of the larval forms of the sheep liver fluke in the snail *Galba bulimoides* by S. B. Freeborn working in cooperation

with [R.] Jay and [D. T.] Snitsin of the U. S. D. A. Bureau of Animal Industry. This snail is said to occur on every range in northern California where liver fluke infestation has been epidemic.

It was demonstrated by Freeborn and F. H. Wymore that dusting with extra light sodium fluosilicate was the most effective method of protecting sweet corn from infestation by the corn ear worm. Black pepper and a pyrethrum extract showed promise as repellents.

It was found by Wymore that so long as a protective covering of hydrated lime (pure) was kept on the foliage of several varieties of cucurbit plants very little damage from the diabrotic beetles (*Diabrotica sorer* and *D. trivittata*) resulted. The work indicates that poison dusts destroy great numbers of the beetles, although very little if any more protection is afforded the growing plants when used as a repellent. A decided reduction in the number of beetles was obtained by the application of a spray consisting of an alcoholic extract of pyrethrum, 1 part to 100 parts of water, applied at frequent intervals as they collected on the plants.

It was found by G. H. Vansell and Freeborn that some comb honeys that could not have been heated are so low in diastatic activity that they could not pass the official European tests. They found a striking correlation between the activity of the diastase and the amount of pollen present. Orange and alfalfa honeys containing little pollen were low in diastatic activity. In respiratory studies with the honeybee by Vansell (E. S. R., 62, p. 159) it was found that in the winter the average production of water and carbon dioxide hourly was 1.3 and 17.6 mg., respectively, while in summer the amounts change to 30.8 and 25.2 mg.

In a further test of the alum spray treatment for the gray garden slug (*Agriolimax agrestis*) (E. S. R., 61, p. 352) by T. I. Storer, night time spraying at the rate of 0.5 to 1 lb. per gallon of water was effective, but greater dilutions did not kill all slugs exposed at the time of treatment. Incidental to a rat poisoning campaign about hog pens, it was found that two pigs weighing 58 and 66 lbs. succumbed to doses of 15 and 30 gm., respectively, or barium carbonate mixed in the morning grain ration. whereas another of about 60 lbs. in weight ingested 6 gm. of the poison with no obvious effect other than development of a slight temporary sensitiveness in the hind legs. The dosage in the fatal cases was at 0.56 and 1 gm. per kilogram of live weight, which is slightly above the lethal dosage rate for rats.

[Report of the Delaware Station department of entomology] (*Delaware Sta. Bul.* 162 (1929), pp. 29-43, figs. 2).—It is reported by H. L. Dozier that choice light pressed menhaden fish oil has given such satisfaction as a spray sticker and spreader that it is now being quite generally used in the commercial orchard sections of Delaware. There has been no indication of foliage burning, and it is felt that this material can now be included in the standard recommendations for the early sprays on apple, peach, and grape.

In a study of the bionomics and control of the codling moth, by Dozier, H. G. Butler, and L. L. Williams, the evidence gathered shows part of the side worm injury to be due to the work of the oriental fruit moth. From some 20 baskets of apple drops of early varieties gathered from beneath the trees early in July, 1928, near Camden and placed in a large outdoor screened cage, 84.7 per cent of the moths issuing represented the codling moth and 15.3 per cent the oriental fruit moth. From 17 bu. of wormy apple culls collected October 4 near Camden and placed in a large outdoor screened cage, 71 per cent of oriental fruit moths and 29 per cent of codling moths emerged as adults. These observations indicate that a large amount of the damage to late apples is due to the work of the

oriental fruit moth, which after the peach crop has been picked center their attack on apples. A cage record kept of 894 codling moths issuing in the spring of 1929 at Camden shows emergence to have extended from April 28 to June 27, the peak of the emergence having been reached the last of May. Two hymenopterous parasites of the codling moth reared in May, 1928, at Woodside were determined by R. A. Cushman as *Aenoplexa carpocapsae* Cush. and *Phytodietus burgesi* (Cress.). In June and July *Ascogaster carpocapsae* was reared in numbers at Camden and appeared to be the most important parasite of the codling moth in Delaware. *Phanerotoma tibialis* was reared from codling moth larvae at Camden on July 27. Both of these species oviposit in the egg of the host and issue from the matured larva after it cocoons.

The common soldier beetle *Chauliognathus marginatus* was found by Dozier in the fall of 1928 in great abundance beneath codling moth bands on apple trees and among apple drops on the ground, also in clusters of ripe grapes on the vines. They readily attacked and devoured larvae of the codling moth and grape berry moth in various stages.

Reference is made by Dozier to the injury of the leafhopper *Erythroneura vitis* Harr. at Newark, where it has been abundant each summer since 1924, and seriously attacked both the Virginia creeper and Boston ivy. Large numbers of its mymarid egg parasite, *Paranagrus* sp., were reared. Sycamore leaves turned yellow and the trees were partially defoliated in 1927 and again in 1929 by the combined attack of the leafhopper *E. maculata maculata* Gil. and the sycamore lace bug (*Corythucha ciliata*).

An attempt by Dozier and Williams to determine the dates of emergence of the adult curculios from overwintering quarters was started April 4, 1929, by jarring various trees. Those on one large tree at Camden, 374 in number, were obtained from April 6 to May 29. At Camden the earliest grubs matured and dropped from the fruit on May 26, with the peak on June 1. From 525 plum drops collected near Bridgeville on May 14 the first mature grubs appeared on May 21, the peak being reached on May 28.

In life history studies of the grape berry moth at Camden and Newark in 1928, by Dozier, Butler, and Williams, a nearly complete third brood developed in the vicinity of Camden but only a partial brood at Newark. A table is given which shows the time of emergence of adults from overwintering pupae at Camden in the spring of 1929, also one which shows the egg deposition by moths of the overwintering brood. The period of egg deposition began on May 24 and ended on July 10, a period of 48 days, the peak of deposition being from June 12 to 15, inclusive. During July, 1928, four species of parasites were obtained at Newark from the grape berry moth, namely, *Basus annulipes* (Cress.), *Glypta mutica* (Cush.), *Diocles obliteratus* (Cress.), and *Microbracon* sp., the first mentioned being the most abundant. The first larvae of this pest to mature in 1929 left the berries and cocooned on June 23, the average length of time from hatching to maturity of 126 larvae being 18.6 days, the maximum 23 days, and the minimum 10 days. Many eggs of the second brood collected in the field during July were parasitized by *Trichogramma minutum* (Riley).

Tables are given which show the dates of deposition of 2,493 eggs laid by the oriental fruit moths and the dates of hatching of 1,800 eggs of the fourth brood, as observed by Dozier and Butler, the average length of the incubation period being 7.91 days.

Review of United States patents relating to pest control, [January–December, 1929], R. C. ROARK (*U. S. Dept. Agr., Bur. Chem. and Soils, Rev. U. S. Pat. Relat. Pest Control*, 2 (1929), Nos. 1, pp. 10; 2, pp. 15; 3, pp. 12; 4, pp. 14; 5, pp. 14; 6, pp. 14; 7, pp. 9; 8, pp. 11; 9, pp. 9; 10, pp. 14; 11, pp. 11;

12, pp. 17).—These abstracts are in continuation of those previously noted (E. S. R., 61, p. 543).

Some effects of temperature and moisture upon *Melanoplus mexicanus mexicanus* Saussure and *Camnula pellucida* Scudder (Orthoptera), J. R. PARKER (*Montana Sta. Bul.* 228 (1930), pp. 132, figs. 26).—The investigations here reported upon, following a discussion of methods of procedure, deal with the influence of temperature upon eggs (pp. 10–43) and upon nymphs and adults (pp. 44–104) and the influence of moisture upon eggs (pp. 104–115) and upon nymphs and adults (pp. 115–126).

It was found that when eggs of *M. mexicanus* were placed at constant temperatures the day they were laid the average length of the egg stage and the percentage of total development per day were as follows: 22° C., 147 days, 0.68 per cent; 27°, 26 days, 3.84 per cent; 32°, 32 days, 3.13 per cent; and 37°, 46 days, 2.17 per cent. The developmental zero for eggs of both *M. mexicanus* and the clear-winged grasshopper was found to be approximately 17° (62.6° F.). No eggs of either species survived a 16-hour exposure to –30°, but at –25° 35 to 50 per cent survived. Soil temperature records indicate that in nature such low temperatures rarely, if ever, occur at a depth of 2 in. The viability of eggs of both species was found to be lowered by an exposure of 3 or more hours at 45°, and the eggs were killed by a 2-hour exposure at 50° or a 20-minute exposure at 60°. Soil temperature records indicate that killing temperatures do not occur at the 2-in. level.

The second and third instar nymphs of both species survived a 24-hour exposure at –7°, and about 50 per cent survived an exposure of the same length at –8°, but all were killed by a 48-hour exposure. An exposure of 24 hours at –10° was necessary to kill adults of *M. mexicanus*, while adults of the clear-winged grasshopper were killed by a 24-hour exposure at –9°.

Although the nymphal period varied from 25 days at 37° to 94 days at 22°, there was less than 5 per cent variation in the total amount of food consumed. At alternating temperatures *M. mexicanus* completed the nymphal stage in less time and on less food than at constant temperature. During the first 20 days of adult life 10 specimens of *M. mexicanus*, held at 37°, consumed 11,587 mg. of dry matter, which was 2.5 times as much as the amount consumed by an equal number at 27°.

It was demonstrated that *M. mexicanus* females can far exceed the production of 2 egg pods, which was previously considered the usual number laid. One female caged in August laid 15 egg pods, and the average for 30 females was 8.8 egg masses. Temperatures ranging from 27 to 37° are favorable to maximum egg production in *M. mexicanus* and from 32 to 37° in the case of the clear-winged grasshopper. In the case of *M. mexicanus* it was found that when reared at 22 and 27° there were always 6 nymphal instars, while at 32 and 37° there were only 5. The clear-winged grasshopper passed through 5 instars at all temperatures at which it could be reared.

A higher percentage of the clear-winged grasshopper eggs hatched in moderately damp soil than under very wet or very dry soil conditions. Submerging eggs of this species in water for a period of 110 days killed approximately 75 per cent. When eggs of *M. mexicanus* were held at constant temperatures and constant relative humidities, a definite zone of optimum conditions was indicated. At 22° the highest percentage of eggs hatched at 80 per cent relative humidity, while at 27, 32, and 37° the optimum was 90 per cent. The higher the temperature the narrower was the range of relative humidity within which hatching took place. Extremely low humidities retard the time of hatching. When exposed to low humidities, eggs of the clear-winged grasshopper and

M. mexicanus lose weight very rapidly. If the moisture content is lowered beyond 50 to 60 per cent the eggs are generally killed. Eggs dried out to a lesser extent regain their original weight when placed in damp sand, and at proper temperature conditions many of them will hatch. *M. mexicanus* eggs lose weight more rapidly at low humidities than eggs of the clear-winged grasshopper.

Field observations and rearing experiments indicate that moisture may affect grasshoppers indirectly through their food supply, food of low moisture content having a tendency to produce larger and relatively longer-winged individuals than highly succulent food. The possibility that the Rocky Mountain grasshopper was merely a dry-weather, migratory phase of *M. mexicanus* is suggested.

A list of 20 references to the literature is included.

Studies on the ox warble flies, *Hypoderma lineatum* and *Hypoderma bovis*, with special reference to economic importance and control, L. I. CASE (Virginia Sta. Tech. Bul. 39 (1929), pp. 12, figs. 2).—A brief account is given of the ox warble flies, including differences between the two species, followed by a report of experiments and observations. Both species are present in Burkes Garden and southwestern Virginia generally. Young cattle, calves, and yearlings particularly are generally more heavily infested than older cattle. The adults appear in Burkes Garden the first warm days in April, although they are at their worst in June and July in a normal season. The larvae ordinarily make their first appearance in the subcutaneous tissues of the back about the first of December, and the first individuals emerge and pupate about the middle of January.

At the time the control was started, *H. lineatum* De V. exceeded *H. bovis* De G. in the ratio of 65 to 35 and the ratio is now 55 to 45. "This more efficient control of *H. lineatum* is no doubt due to the fact that April and May extractions were in some cases neglected because the cattle had been turned to summer range. Salt, wet or dry, is an ineffective dressing for killing *Hypoderma* larvae in the subcutaneous tissues of the host. Benzol, 90 or 100 per cent, injected into larval cysts effects a high percentage of kill. Hand extraction at intervals of 30 days repeated five times is a practical and effective means of control. Hand extraction performed by the average farm worker causes an occasional case of anaphylaxis (0.037 per cent), for that reason it should be done with reasonable care to avoid the bursting of larvae or cysts. Individual effort is not effective as a means of control, due to the fact that the adult *Hypoderma* travels a considerable distance. However, immediate benefits from increased gains in weight and milk flow will pay well for the labor involved. Control measures as practiced in Burkes Garden have reduced *Hypoderma* infestation by approximately 50 per cent.

"Extraction of *Hypoderma* larvae from the subcutaneous tissues of the host affects gains in weight and milk flow advantageously. Cattle owners of Burkes Garden who have participated in four years of control efforts think the work has been worth while and wish to continue. Cooperative measures to be effective should be supervised closely."

Cranberry false blossom and the blunt-nosed leafhopper, C. S. BECKWITH and S. B. HUTTON (New Jersey Stat. Bul. 491 (1929), pp. 16, figs. 6).—This is a report of studies of false blossom, which at the present time is the most serious disease of the cranberry plant in New Jersey, having spread rapidly during the last five years. The disease has been distributed widely by the planting and carrying of vines from bog to bog, and if unchecked it is thought that it will ruin all of the bogs in the State. The work has shown the disease to be carried from plant to plant in the bog by the blunt-nosed leafhopper, *Euscelis*

striatulus (Fall.). This disease can not be cured by any known method, but its spread can be controlled by the elimination of the carrier.

This leafhopper is a single brooded insect, the egg hatching in early June, and the active nymphs or adults being present on the bogs as late as October. It was found that a late reflow, made as soon as all of the blunt-nosed leafhoppers have hatched and held to a head for 12 hours, supplemented by kerosene sprayed on the leafhoppers that float on the drift, will give control. Holding the winter flowage until July 5 will kill all of the eggs of the pest, and control also can be obtained by the use of pyrethrum sprays.

Boll weevil control tests (*Georgia Coastal Plain Sta. Bul. 11 (1929), pp. 20, 21*).—A brief reference is made to work conducted with a view to determining the most effective method of using arsenical poisons for boll weevil control. The results of poisoning work, extending over a period of six years (E. S. R., 60, p. 167), are said to show conclusively the value of early poisoning and that the early applications should begin from a week to 10 days before squaring. Two or preferably three applications should be made at weekly intervals. Later applications can be made most efficiently with calcium arsenate dust.

Establishment in State of newly introduced mealybug parasites, H. S. SMITH and H. COMPERE (*Calif. Citrogr., 14 (1928), No. 1, p. 5, fig. 1*).—The successful establishment of at least three of the newly introduced parasites of the citrophilus mealybug into southern California, representing the genera *Coccophagus*, *Tetraneura*, and *Diplois*, is reported.

A study of hibernation of the corn earworm in Virginia, W. J. PHILLIPS and G. W. BARBER (*Virginia Sta. Tech. Bul. 40 (1929), pp. 24, figs. 10*).—Studies conducted at Charlottesville in central Virginia from 1921 to 1928 and at Richmond from 1926 to 1928 are reported under the headings of methods; emergence during the summer and fall; when individuals enter hibernation; nature of the hibernation quarters; fate of individuals entering hibernation, including mortality of larvae and of pupae and proportion successfully hibernating; period of emergence of moths from hibernation; length of hibernation period; and factors influencing survival of hibernation.

It was found that in summer the period from the time the larvae entered the soil until moths emerged ranged from 14.6 to 19.9 days. The relative percentages of summer emergence and of fall emergence from individuals which entered the soil during August and September varied with the food and the time when the larvae became full grown. Larvae that fed on dough-stage kernels seemed to have a tendency to hibernate even when they became full grown in midsummer, while larvae that fed on corn leaves showed a tendency to emerge during the fall even when they became full grown about the middle of September. Fall emergence was greatest from those individuals that pupated at a depth of only 2 to 3 in. Those individuals that entered the ground from the first to the third week in September usually hibernated most successfully, provided they had the proper food.

"Larvae entering the soil construct an emergence burrow for the escape of the adult. The pupae rest in a cell or enlarged space at the bottom of the burrow. The depth of the pupal cell ranges from 0.5 to 9 in., depending upon the type of soil and the season. Larvae construct comparatively shallow burrows in the summer but go much deeper in the fall.

"The average percentage of larvae that failed to pupate after entering the soil ranged from 41.8 per cent in 1926 to 43.7 per cent in 1927. Mortality of pupae occurs throughout the hibernating period, although it is greatest from November to January. Summer emergence averaged 5 per cent for the period of the investigations. Emergence may occur from the last of May until Au-

gust; the earliest emergence was May 26, the latest August 24. The maximum emergence occurred during June and July. The average mean date of emergence for all years was July 8. The length of the emergence period varied in different years. Individuals retained in salve boxes and kept indoors hibernated, although some emergence occurred throughout the hibernation period. The minimum hibernation period for these experiments proved to be 248 days, the maximum 367 days. Hibernating individuals may be present in the soil throughout the year. It was found that individuals hibernated more successfully in soils rich in clay than in lighter soils, except in soils very rich in humus. The kind and quantity of vegetation has a direct bearing on the survival of hibernating individuals. Roots often follow and fill the emergence burrows or they may close the exits of burrows and prevent the escape of moths.

"The mole is the most important predacious enemy of hibernating pupae in the area studied. When they gained access to cages they destroyed as high as 92 per cent of the hibernating pupae. Earthworms frequently fill emergence burrows with castings and thus may prevent the emergence of many moths. Experiments have shown that the ear worm hibernates more successfully in a dry condition than under the normal precipitation of natural field conditions. A larger percentage of individuals hibernated successfully in the field cages during the season of very light precipitation (October 1, 1923, to June 30, 1924) than in any other year. Field experiments indicated that excessive rains during the normal emergence period delayed emergence. Individuals emerged from dry hibernation considerably later than from hibernation under natural conditions. Shade also was found to delay emergence and to limit the percentage that hibernates successfully."

How to prevent damage by the Mexican bean beetle, *S. MARCOVITCH* (*Tennessee Sta. Circ. 23* (1930), pp. 2, fig. 1).—A practical account.

Biology and control of the southern corn rootworm, *F. S. ARANT* (*Alabama Sta. Bul. 230* (1929), pp. 46, figs. 14).—This is a report of studies of a serious pest of corn planted after winter legumes or on bottom lands, the adult, officially known as the spotted cucumber beetle, being a pest of less importance upon cucurbits, melon crops, and flowers.

Three complete generations and a partial fourth occur annually in Alabama. The adults of the third generation overwinter and begin oviposition during the latter part of January. Oviposition is practically continuous throughout the spring and summer to the middle of October. There is a high correlation between the temperature and the rate of development. The average number of days required for development from egg to adult in 1928 decreased from 81 when the mean temperature was 55° F. (eggs deposited February 3) to 33 when the mean temperature was 79° (eggs deposited August 5). The average number of days required in development for individuals of the first, second, and third generation was 58, 34, and 32, respectively, in 1927, and 65, 36, and 32, respectively, in 1928. A dry environment is fatal to the immature stages, and a cold environment (10° or below) causes a high mortality of adults. Adults are parasitized by a tachinid fly which is of considerable importance in reducing the number of adults in the late winter and early spring months, but it is of little importance during the hot summer months.

The most serious injury to corn is produced by half grown to mature larvae attacking the young seedlings. In most cases these larvae are older than the corn attacked. Adults congregate upon winter legumes and deposit their eggs in the soil. The larvae emerge from the eggs and feed upon the roots and nodules of the legumes and the roots of wild grasses until the soil is turned and the corn, which in common practice is planted after the legume, germinates, at

which time they attack the young plants. Newly hatched larvae also attack the seedlings, but do less damage than the older ones.

The data in this report indicate that winter legumes preceding corn in the latitude of Auburn should not be turned before April 1 of a normal year. If legumes are turned April 1, it is unsafe to plant corn within three weeks from the date of turning. If legumes are turned April 15, it is unsafe (but to a lesser extent) to plant corn within two weeks from the date of turning. In either case the land should be thoroughly disked or harrowed after turning to destroy the larvae's supply of food. The data indicate further that corn grown on damp bottom lands, or any other susceptible areas not associated with legumes, should be planted about May 1 of a normal year. The soil should be turned several weeks (3 to 5) previous to planting and, by light cultivations, kept free of host plants. Crop rotation is not an effective control measure. Adults of the pest may obtain a lethal dose of poison by using their mandibles to clean off the dust picked up by the tarsi while crawling over the dust-covered surface of a plant. Sodium fluosilicate diluted with hydrated lime in the proportion of 1 to 3 appears to be the most satisfactory material to use in controlling the adults.

A bibliography of 69 references to the literature is included.

Corn-borer developments during 1929, W. P. FLINT, G. H. DUNGAN, and A. L. YOUNG (*Illinois Sta. Circ. 350* (1930), pp. 4, figs. 2).—It is pointed out that no outstanding developments took place in the corn borer situation during 1929. The borer advanced into new territory at about the normal rate, no infestations having actually been found in Illinois during the year, although known infestation occurred only 15 miles away. In tests made in which 24 varieties and strains were grown for the second year in the area of heaviest infestation, some superior strains showed a marked resistance. The strain with the lowest average infestation had only 6 per cent of the plants infested, and the variety with the highest infestation had borers in 58.6 per cent of the stalks. The preceding year the same two varieties showed 9.8 and 62.6 per cent of infestation, respectively.

Fungous diseases of the honeybee, C. E. BURNSIDE (*U. S. Dept. Agr., Tech. Bul. 149* (1930), pp. 43, pls. 6, figs. 5).—A brief historical account is followed by a report of investigations with pathogens and then the results of experiments with bees. The fungi shown to be pathogenic include species of *Aspergillus* and *Mucor*, and the *Saccharomycetes*, several species of *Aspergillus* and one of *Mucor* being the most important. A list is given of 33 references to the literature.

ANIMAL PRODUCTION

Effect of storage in finely divided feeds upon the stability of the D vitamin of cod-liver oil, L. C. NORRIS, G. F. HEUSER, and H. S. WILGUS (*New York Cornell Sta. Mem. 126* (1929), pp. 15, figs. 3).—In 2 experiments a Norwegian cod-liver oil was used which had been found to prevent or nearly prevent rickets in chicks up to 8 weeks of age when fed at a 0.5 per cent level. This oil was incorporated in a mash mixture for 4 lots of 34 chicks each in test 1 and 38 chicks each in test 2. In lot 1 the oil was mixed with the mash each week, in lot 2 it was mixed and stored for 4 weeks, in lot 3 for 8 weeks, and in lot 4 for 12 weeks, and a fifth lot was used as a control lot.

In a third test 8 lots of 35 chicks each were fed a red cod-liver oil of Newfoundland origin, which was found to prevent rickets up to 8 weeks of age when fed at a level of 0.3 per cent. In this test lots 1, 2, 3, and 4 received fresh oil mixed in the mash each week at the rate of 0.5, 0.4, 0.3, and 0.2 per

cent, respectively; lots 5, 6, 7, and 8 the same respective amounts as the preceding lots, but the oil had been mixed with the feed for 16 weeks; and a ninth lot was used as a control lot. In all the tests the mash containing cod-liver oil was stored in burlap bags and held at room temperature.

The rate of growth and the percentage of rickets that developed during the 3 tests showed that some destruction of the vitamin D in cod-liver oil occurred during storage in mash mixtures. The amount of vitamin D destroyed varied directly with the length of the storage period. In the third test an approximately normal growth was obtained and rachitic lameness and reduction in bone ash were prevented by feeding 2.5 times the minimum dose of cod-liver oil stored for 16 weeks.

Commercial feeding stuffs, L. S. WALKER and E. F. BOYCE (*Vermont Sta. Bul. 305* (1929), pp. 38).—This is the usual report (E. S. R., 61, p. 758) of the protein, fat, and fiber content of 1,369 samples of feeding stuffs collected for official inspection during April, 1929.

[**Experiments in animal nutrition at the New York Cornell Station**] (*New York Cornell Sta. Rpt. 1929*, p. 22).—The results of two studies are noted.

Rock products as mineral feeds.—Feeding rock phosphate has been found to have a deleterious effect upon growth and bone formation, due to its fluorine content. Extended tests with rats and short-time tests with pigs have shown that phosphatic limestone is a satisfactory source of calcium for bone formation, and that it contains about one-third as much fluorine as rock phosphate.

The specific effect of certain meats upon growth and fat deposition.—In these studies, rats on liver diets grow to very unusual size. Studies are under way to determine the specific factor in meat which causes this unusual growth.

The tale of the prize winners, J. H. SHEPHERD (*North Dakota Sta. Circ. 39* (1930), pp. 8, figs. 5).—A description of the methods of breeding and fitting of some of the prize winners at the 1929 International Livestock Exposition, Chicago, Ill., is given.

The digestibility of cottonseed meal as a supplemental feed for range cattle in New Mexico, W. E. WATKINS (*New Mexico Sta. Bul. 178* (1929), pp. 42, figs. 3).—Concluding this study (E. S. R., 61, p. 258), it was determined that a larger percentage of nutrients was digested when the nutritive ratio ranged from 1:2.8 to 1:6.1, as was true when cottonseed meal was fed with wheat straw, than when the nutritive ratio was 1:18, as was the case when wheat straw was fed alone. Less crude fiber seemed to be digested as the nutritive ratio narrowed from 1:6.1 to 1:2.8. Adding cottonseed meal to the wheat straw ration increased the total amount of dry matter, organic matter, nitrogen, ether extract, nitrogen-free extract, and ash digested, thus narrowing the nutritive ratio of the wheat straw. On the other hand, adding large amounts of nitrogenous matter did not seem to affect the digestibility of the crude fiber of the wheat straw.

[**Lamb feeding studies at the California Station**] (*California Sta. Rpt. 1929*, p. 61).—Continuing the feeding studies with lambs (E. S. R., 61, p. 361), 5 lots of 45 lambs each were fed alfalfa hay and the following concentrates: Whole barley, whole barley and cottonseed meal 8:1, whole barley and rice bran 1:1, whole barley and bean screenings 1:1, and bean screenings, respectively. The gains obtained in lots 1 and 2 indicated no advantage from the addition of cottonseed meal. The rice bran fed in lot 3 produced gains practically equal to those obtained in lot 2, and no ill effects were apparent due to the rice bran. Lots 4 and 5 made the lowest gains. Lot 4 showed a preference for the barley, and some difficulty from scours occurred in lot 5. Due to the low price of the beans, lot 5 made the cheapest gains, while lot 2 made the most expensive.

Cottonseed meal with various roughages as fattening rations for lambs, R. F. Cox (*New Mexico Sta. Bul. 179 (1929), pp. 24, figs. 8*).—Concluding this study, brief progress reports of which have been previously noted (*E. S. R.*, 61, p. 259), three trials have been conducted to determine the value of cottonseed meal as a supplementary feed. In the first trial 7 lots of 10 lambs each, in the second trial 7 lots of 20 lambs each, and in the third trial 5 lots of 20 lambs each were fed for periods of 84, 92, and 109 days, respectively. The roughages, which were fed ad libitum in the respective lots, were as follows: Alfalfa hay, cottonseed hulls (lots 2, 3, and 4), chopped cane stover, chopped corn stover, and alfalfa hay. In addition lot 1 received 0.75 lb. of corn and 0.25 lb. of cottonseed meal, lot 2 0.5 lb. of cottonseed meal, lot 3 1 lb. of cottonseed meal, lot 4 1.25 lbs. of cottonseed meal, and lots 5, 6, and 7 1 lb. of cottonseed meal per head daily. In the third test, lots 5 and 6 were omitted.

In this study lambs were thus fed as much as 1 lb. of cottonseed meal per head daily for periods of from 90 to 100 days without serious loss due to poisoning or malnutrition, especially when roughages other than cottonseed hulls were fed. In all three trials the gains in lots 1 and 7 were practically the same. Based on the amount of concentrates required per pound of gain, cottonseed meal fed at the rate of 1 lb. daily and supplemented with various roughages was approximately 85 per cent as efficient as corn supplemented with cottonseed meal and with alfalfa hay as a roughage. The gains in lots 3, 5, and 7 were almost equal to those in lot 1.

A death loss of 3.23 per cent in lots receiving cottonseed meal and hulls was attributed to nutritional troubles. Symptoms of cottonseed meal poisoning became apparent in from 60 to 75 days after the start of feeding. Outward symptoms of this trouble were loss of appetite, general depression, continually lying down and getting up, a bloated appearance, thumpy, jerky movements in the region of the paunch, and severe emaciation. If sick lambs were removed from the lots when they went off feed and were fed a different ration, complete recovery occurred in all cases.

On the average it required from 10 to 14 days to get lambs on a full feed of 1 lb. of cottonseed meal, and when alfalfa hay was fed it had to be limited during this period. No difficulties were experienced in lambs going off feed on 1 lb. of cottonseed meal daily. After from 65 to 75 days of feeding 1.25 lbs. of cottonseed meal it was impossible to get the lambs to clean up all the meal, but even then they did not go off feed. Post-mortem examination of lambs dying of cottonseed meal poisoning showed gas formation in the small intestine, serum in the abdominal cavity, distension of the gall bladder, and severe congestion and inflammation of the true stomach.

An analysis of cottonseed meal and cottonseed hulls for gossypol, by W. E. Watkins, is included (pp. 20-22).

Growth and reproduction in swine, F. F. MCKENZIE (*Missouri Sta. Research Bul. 118 (1928), pp. 67, figs. 32*).—In concluding this series of studies (*E. S. R.*, 53, p. 464), the records of 60 sows and their litters are reported. The sows representing the well-fed groups from the eleventh to the sixteenth generations of continued early breeding made the fastest gains and attained the greatest size of all groups. While breeding sows to farrow their first litter at less than 1 year of age did not interfere with the mature weight of the sows if well fed, limiting their feed delayed mature weight indefinitely. There was but little difference in the growth of sows bred first when 18 months of age and those bred first at 24 months of age. The well-fed, early bred sows were only slightly smaller at 20 months of age than later bred sows, and the former group continued to grow until from 80 to 90 months of age, while the latter group were fully grown at from 35 to 45 months of age.

While the degree of fatness had a marked influence on body measurements, there was some evidence that early bred sows maintained on a low plane of nutrition were retarded in growth, but there was no real inhibition in skeletal development. In this study pregnancy neither retarded nor accelerated growth.

The average gestation period was 118.5 days, and neither age of sow, size of litter, nor plane of nutrition appeared to affect the length of this period. Lactation was a heavy drain on rapidly growing sows, and probably accounts for the difference of from 12 to 17 cm. in height at withers between well-fed and limited-fed sows at 18 months of age. Well-fed sows suckling small litters gained in weight throughout the suckling period, but litters of 7 or more caused sows to lose rapidly, and they showed no gain until the third week after weaning. The loss during the second half of the suckling period was about two-thirds that during the first half. The better the sows were fed, the greater were the losses. On the other hand, the sows losing weight rapidly during the suckling period produced the largest pigs at weaning time. The weight of the pigs at this time was greatly influenced by the condition of the sow at farrowing time.

First-litter pigs weighed less at weaning time than those of later litters. Pigs from well-fed sows were consuming about 1 lb. more of grain per head daily than those from poorly fed sows at weaning time. It required on the average 17 days more to finish pigs from sows on a low plane of nutrition as compared with those from sows on a high plane of nutrition. In addition the plane of nutrition of the sow affected the birth weights of her pigs.

Of all the pigs farrowed, 51 per cent were males, and of the dead pigs farrowed, 55 per cent were males. The male pigs averaged 0.09 lb. more at birth than female pigs. The average birth weight of pigs in litters of 6 pigs or less was from 2.4 to 2.68 lbs. per head, and in the larger litters from 2.05 to 2.41 lbs. per head. The birth weight of the litter ranged from 5 per cent of the live weight of sows weighing 400 lbs. or over to 7.11 per cent of the live weight of sows weighing under 200 lbs. Low feed consumption during the last half of gestation was associated with the low gains during the period and with low litter weights. The better fed sows lost the greatest amount of weight at parturition time.

While the results do not indicate any relationship between the size of litter and the gains in weight made the 2 weeks previous to breeding, there was a definite correlation between the gains made the month following conception and the size of litter. Farrowing records show that January was the most unsatisfactory month for sows to farrow, and that for poorly fed sows February was also unsatisfactory.

Post-mortem examination of sows on a low plane of nutrition showed that the growth of the genital organs was so retarded that sexual maturity was delayed until the animal was from 11 to 12 months of age.

[Experiments with swine at the California Station] (*California Sta. Rpt. 1929, pp. 62, 63*).—A lot composed of 20 purebred Poland China and 20 Duroc-Jersey pigs, fed rolled barley and skim milk on alfalfa pasture from June 16 to November 3, weighed 179.16 lbs. each at the end of the test. A similar lot, fed the same feeds in dry lot over the same period, weighed 186.79 lbs. each. The lots were so fed that the gains were approximately equal. The percentage of soft carcasses produced by the two breeds was the same as previously noted (E. S. R., 59, p. 785). This experiment was conducted in cooperation with the U. S. Department of Agriculture.

Continuing the study of "leg stiffness" in swine (E. S. R., 61, p. 362), three sows were bred in May and placed out of direct sunlight on June 5. They were fed barley and tankage 10:1, and alfalfa hay. Two litters were farrowed in

September, while the third sow, which failed to settle until the latter part of July, did not farrow until November. All the sows farrowed normally, and the pigs appeared normal at birth. The ration for the pigs after weaning was the same as that for their dams. The September pigs showed definite signs of stiffness in December and on January 1 were about one-half as large as normal pigs. The November pigs grew slowly, but showed no signs of stiffness.

[Experiments with swine at the Delaware Station], A. E. TOMHAVE (*Delaware Sta. Bul. 162 (1929), pp. 22, 23*).—Results of experiments in continuation of those previously reported (*El. S. R.*, 60, p. 763) are noted.

Protein supplements for pigs.—In this phase of the study, 5 lots of 10 pigs each were fed on forage for 85 days on a basal ration of shelled corn. Lot 2 was on alfalfa pasture, and the other lots on rape pasture. The following protein supplements were fed in the respective lots: Ground soybeans, ground soybeans, tankage and ground soybeans, equal parts, whole soybeans, and tankage. The average daily gains were 1.03, 0.94, 0.96, 1.03, and 1.19 lbs. per head in the respective lots.

A basal ration made up of 120 lbs. of corn meal, 40 lbs. of middlings, and 4 lbs. of alfalfa leaf meal was fed for a period of 73 days to 2 lots of 9 pigs each in dry lot. The supplement fed with the basal ration was 10 lbs. of tankage in lot 1 and 25 lbs. of ground soybeans plus 0.75 lb. of bone meal in lot 2. The average daily gains were 1.62 and 0.79 lbs. per head in lots 1 and 2, respectively.

Forage crops for swine in Delaware.—On a ration of shelled corn and tankage on soybean forage a lot of 10 pigs made an average daily gain of 1.41 lbs. per head during a 69-day period and required 415 lbs. of concentrates per 100 lbs. of gain.

Swine feeding experiments, W. L. ROBINSON (*Ohio Sta. Spec. Circ. 26 [1930], pp. 16*).—The results of several studies, in part previously noted (*El. S. R.*, 60, p. 461; 62, p. 660), are presented.

Quantity of feed and protein and minerals for pigs on legume pasture (pp. 4-6).—In this study 8 lots of 8 to 10 pigs each, averaging approximately 73.5 lbs. per head, were fed on legume pasture from June 13 until they reached an approximate final weight of 200 lbs. each. Corn was fed in all lots, and tankage in all except 5 and 6. Salt was fed to the first 5 lots, and minerals to the last 3. Lots 1 and 8 were on a limited feed the entire time, lot 2 was fed a limited feed to 125 lbs. and then full fed, lots 3, 5, 6, and 7 were full fed twice daily, and lot 4 was self-fed.

The average daily gains were 0.94, 1.22, 1.48, 1.63, 1.35, 1.44, 1.52, and 0.98 lb. per head in the respective lots. Limiting the ration, as in lot 1, produced more gain from a given amount of feed than full feeding, but the pigs gained more slowly and were not ready to market until prices began to decline in the fall. By following the practice in lot 2, the pigs required less feed per unit of gain than with full feeding. The self-fed pigs gained more rapidly but at a somewhat greater cost than those full fed twice daily. In this test corn and minerals produced a very good gain at a reasonable cost per pound of gain, while when tankage was added a further improvement in the ration resulted. No benefits were found from adding minerals when the ration was limited.

Protein supplements for pigs on rape pasture (pp. 7, 8).—Protein supplements were fed with corn to 5 lots of 9 or 10 pigs each, averaging slightly over 68 lbs. per head, in amounts to give a nutritive ratio of 1:6.6 until the pigs weighed 125 lbs., and then in amounts to give a nutritive ratio of 1:7.2. Each lot of 10 pigs was on 0.5 acre of rape. All lots received minerals and in addition lots 4 and 5 were fed ground oats. The protein supplements used in lots 1 and 4 were tankage, lots 2 and 5 tankage and linseed meal, and lot 3 tankage

and cottonseed meal. The pigs were fed to an average final weight of approximately 200 lbs.

The average daily gains were 1.51, 1.49, 1.52, 1.34, and 1.49 lbs. per head in the respective lots. The feed required per 100 lbs. of gain was lowest in lot 1 and highest in lot 4. In lots 3 and 5 the feed requirement was somewhat higher than in lot 1, and in lot 2 but slightly lower than in lot 4.

Soybeans for fattening shotes in dry lot (pp. 9, 10).—In a test with 7 lots of 5 pigs each, averaging 110 lbs. per head, on a basal ration of ground corn, ground alfalfa, and minerals, cooked soybeans produced faster and greater gains from a given amount of feed than tankage. A mixture of soybeans and corn 1:12 proved deficient in protein as compared with a mixture of soybeans and corn 1:6. The addition of 5 per cent of cottonseed meal to a ration of soybeans and corn 1:6 increased the rate and economy of gains. The Midwest variety of soybeans had a higher feeding value than Manchus soybeans of equal quality. The whole Midwest beans produced somewhat faster and more economical gains than ground Midwest beans.

Soybeans for growing and fattening pigs (pp. 11-14).—This is a discussion of the use and practices in feeding soybeans in rations for growing and fattening pigs.

Johnson grass hay versus timothy hay as a feed for horses and mules, J. C. GRIMES and W. C. TAYLOR (*Alabama Sta. Circ. 54* (1930), pp. 8).—A comparison of these two hays was made in two tests, using 9 horses and 19 mules in the first test, and 40 horses in the second test. The animals were divided into two lots in each test, and one lot was fed oats and Johnson grass hay while the other lot received oats and timothy hay. In the first test the animals were doing heavy work and in the second test light work.

In test 1, the lot receiving Johnson grass hay consumed on the average 11.74 lbs. of oats and 9.4 lbs. of hay daily per 1,000 lbs. of live weight, lost an average of 21.79 lbs. per head during the 84-day period, and refused 4.97 per cent of the hay offered. The other lot had an average daily consumption of 11.06 lbs. of oats and 9.36 lbs. of timothy hay per 1,000 lbs. of live weight, lost 10.71 lbs. per head during the test, and refused 0.72 per cent of the hay fed. The average daily feed cost, based on the existing market prices, was 51 cts. per head in the Johnson grass lot and 52.5 cts. in the timothy hay lot.

The average daily feed in the second test was 9.42 lbs. of oats and 11.31 lbs. of Johnson grass hay and 9.69 lbs. of oats and 11.4 lbs. of timothy hay per 1,000 lbs. of live weight. During the 140-day test the animals receiving Johnson grass hay gained an average of 56.25 lbs. per head, while those receiving timothy hay gained 57.7 lbs. The average daily feed cost per head was 34 cts. in the Johnson grass hay lot and 37 cts. in the timothy hay lot.

In neither test was there any noticeable difference in the health and vigor of the animals or in their ability to do work based on the feed consumed.

[*Experiments with poultry at the California Station*] (*California Sta. Rpt. 1929*, pp. 94, 95).—Continuing the studies on egg quality (E. S. R., 59, p. 771), experiments were conducted to determine the percentage of eggs in which the air cell could be loosened by shaking. No correlation was found between the loosened air cell and the actual viscosity of the albumin. It has been impossible to correlate variations in yolk color with age of hen, total number of eggs produced, size of egg, or thickness of shell. It has also been impossible to produce any marked change in color by changes in the ration such as withholding green feed, substituting meat scrap for fish scrap, or by adding wet mash to the ration.

The results of studies on the protein requirements for growth in baby chicks indicate quite clearly higher protein requirements than are commonly con-

sidered. For egg production, on the other hand, preliminary results indicate a lower requirement than that generally assumed.

Studies on the mortality of chick embryos have shown that in spite of careful candling over 7 per cent of all candled infertiles showed positive development when broken. In these eggs very slight or no development of the vascular area or blood were obtained, and in some cases no embryo could be found. These results led to the conclusion that previous work on mortality curves in which eggs candled as infertile were not examined do not accurately represent the mortality for the first two days of incubation.

A study of air flow in electric brooders showed that when one-fourth of the air was replaced each minute the carbon dioxide concentration was so low as not to be a factor in chick development.

Poultry house ventilation and temperature control studies showed that while roof insulation was of value, it was not so important as natural ventilation in controlling high temperatures. Mechanically forced air circulation and sprinkling of roofs were not found effective in controlling high temperatures.

[Poultry experiments at the Delaware Station], A. E. TOMHAVE and C. W. MUMFORD (*Delaware Sta. Bul.* 162 (1929), pp. 25, 26).—Several experiments are briefly noted.

Confinement of laying pullets without succulent green food.—The average egg production per bird was slightly less in a confined pen as compared with that of a pen on range. At the end of the experiment the confined birds weighed on the average 3.85 lbs. per head, while those on range averaged 3.43 lbs. The confined birds required 0.44 lb. more feed to produce 1 dozen eggs than those on range.

All-mash method of feeding pullets.—During a 337-day test a pen of 55 birds was fed a scratch and mash ration, while a similar pen received an all-mash ration. The average egg production was 140.8 and 138.6 eggs per bird in the respective lots. Birds receiving scratch and mash required 0.65 lb. more feed per 1 dozen eggs than those on all mash. Mortality records showed that 6 birds in pen 1 and 2 birds in pen 2 died during the experiment.

Rearing chicks in confinement.—In this study two lots of 450 chicks each were raised in confinement and fed no green feed, but had 4.75 per cent of alfalfa leaf meal added to the growing mash. One lot was provided with a concrete sun porch and the other lot had access to a sun porch with a wire floor. Health and mortality were practically the same in both pens, and in each some symptoms of cannibalism were manifested. The feathers of the chicks on concrete were more soiled than those on wire, and more labor was required to keep the concrete clean. These two lots of chicks were more uniform in all respects than chicks raised on range.

[Experiments with poultry at the New York Cornell Station] (*New York Cornell Sta. Rpt.* 1929, pp. 61-63).—The results of several experiments are briefly noted.

Incubation research.—In these studies high humidity was found to be an aid in the transformation of calcium from the eggshell to the body of the chick embryo. High humidity also had a beneficial effect upon the growth of the embryo during the first part of the incubation period, but just prior to hatching was very detrimental.

Three well-defined cycles have been found in the growth of the chick embryo, due to the normal chemical and physiological processes in the course of the embryonic development.

Effect of seasonal variation of sunshine.—The ultra-violet rays in summer sunshine were found to be about 4 times as potent as those of spring sunshine

for preventing rickets in chicks, and spring sunshine was approximately 4 times as potent as winter sunshine. The average daily exposure necessary to prevent rickets in chicks was 2.5 minutes in summer, 10 minutes in spring, and 40 minutes in winter.

Effect of keeping on the vitamin-D potency of cod-liver oil.—The results of 3 year's work indicate rather conclusively that cod-liver oil loses its anti-rachitic value when stored in mixed feed. It loses about one-half of its potency when stored at room temperatures for 3 months in ground feed. The loss is apparently due to oxidation.

Utilization of calcium by the growing chick. F. E. MUSSEHL, R. S. HILL, M. J. BLISH, and C. W. ACKERSON (*Jour. Agr. Research* [U. S.], 40 (1930), No. 2, pp. 191-199, figs. 8).—Concluding this study at the Nebraska Experiment Station (E. S. R., 61, p. 861), it was found that the utilization of calcium in normal bone growth seemed to depend upon two factors, (1) its assimilation and (2) its fixation in the bone cell itself. Adding 0.5 per cent of magnesium in the form of carbonate and sulfate to the basal mixture of corn, wheat, and milk proteins did not markedly affect the rate of growth of chicks, but rickets did result from the magnesium carbonate additions.

Washington chick rations. J. S. CARVER, W. D. BUCHANAN, and M. W. MILLER (*Washington Col. Sta. Pop. Bul.* 146 (1929), pp. 19, figs. 8; also *Western Washington Sta. Bul.* 15-W (1930), pp. 18, figs. 8).—The management of chicks, the essentials of a good chick ration, method of feeding, and schedule for feeding of chicks up to the time they enter the laying house are described in these publications.

Final report third Panhandle egg laying contest, November 1, 1928, to October 26, 1929. O. S. WILLHAM ([*Oklahoma*] *Panhandle Sta., Panhandle Bul.* 13 (1929), pp. 16).—This is the report of the third Panhandle egg-laying contest, held at Goodwell, Okla. (E. S. R., 62, p. 461).

DAIRY FARMING—DAIRYING

[*Experiments with dairy cattle at the New York Cornell Station*] (*New York Cornell Sta. Rpt.* 1929, pp. 20-22, 23).—The results of several studies are briefly noted.

Proper amount of protein for dairy cows.—In this study three groups of 12 cows each were fed mixed clover and timothy hay and corn silage. In addition one group received a grain mixture containing 16 per cent of protein, the second group 20 per cent of protein, and the third group 24 per cent of protein. No significant difference was noted in the effectiveness of the three rations. The production of milk and butterfat was practically the same, as was also the thrift and ability of the animals to maintain weight.

The influence of a low-fat ration upon milk secretion.—Feeding a ration from which most of the fat had been removed by extracting the concentrate part with benzine resulted in an approximate 20 per cent decline in milk yield. While the percentage of butterfat was unaffected, the physical and chemical nature of the fat, as indicated by the iodine number, was markedly affected.

Blood studies with milking animals.—In studies made with rations of different fat content it was found that the drop in milk yield was accompanied by a decrease in blood lipids.

Significance and causes of daily fluctuations in weight in dairy cattle.—The conclusions reached in this study were that the selection of the proper time to weigh is the most important factor in obtaining uniform weights, and that watering has a stabilizing effect on the weight of animals. Heat periods appear to decrease weight temporarily. With dairy cows weight varies in

proportion to size, but the standard deviation for a single weighing is 1.21 per cent of the live weight regardless of size. A single weighing of 6-months-old calves may vary 2.13 per cent of their live weight. To obtain odds of 30 to 1 against a change in live weight being due to chance, a difference of 2.6 per cent of the live weight of the animal is necessary for a single weighing, while if the animal is weighed on 3 successive days the difference is reduced to 1.17 per cent, and for 5 successive days to 0.8 per cent.

A study of breeding records of dairy herds, C. H. ECKLES (*Minnesota Sta. Bul. 258 (1929), pp. 15*).—This study is based on the records of the university herd beginning with the year 1900. on the records of two branch station herds over a period of several years, and on records of highly developed purebred herds in the State.

Over the 29-year period, 39.7 per cent of the services with fertile cows resulted in conception, and the average abortion rate was 14.6 per cent. The average yearly fat production for 2-year-old heifers increased from an average of 265 lbs. the first 5 years to 500 lbs. the last 4 years. The number of services per conception, rate of abortion, and proportion of nonbreeders showed no tendency to increase throughout the test. The fact that 47 cows, with average fat records of 342 lbs. per year as compared with an average of 350 lbs. for the entire herd, became nonbreeders, that breeding troubles did not greatly increase with increased production, and that of 37 cows with records of over 600 lbs. of fat per year only two were nonbreeders shows rather conclusively that within the university herd at least the level of production had no relation to breeding troubles.

Only 7.4 per cent of the females in the herd never conceived. A noticeable but not marked increase in the number of nonbreeders occurred between the ages of 2 to 10 years, but after 10 the proportion increased rapidly.

The percentage of services with fertile cows resulting in conceptions was from 44.5 to 62 in 5 purebred privately owned dairy herds, and about the same percentage was found in 2 demonstration herds at branch stations. In the university herd no significant seasonal variations were found in the percentage of services resulting in conception.

About half of the pregnancies occurred from the first service. The percentage of services resulting in conception decreased with further service periods until after a cow had passed five without results. when the chances were 1 in 6 that she would conceive at the sixth, and about 1 in 13 when the tenth period was reached. It is considered advisable to discard ordinary cows when they fail to conceive after 5 service periods, but that valuable animals may justify further services.

Of all aborting animals in the study, 21 per cent were sterile following abortion, showing this disease to be a factor in sterility. In all there were 109 cases of sterility, of which 21 per cent were heifers that never conceived, 24 per cent followed abortion, 51 per cent were preceded by a normal calving, and 4 per cent had incomplete records so that no cause for sterility could be assigned.

Selecting the dairy sire, A. C. RAGSDALE and W. GIFFORD (*Missouri Sta. Bul. 274 (1929), pp. 20, figs. 10*).—The selection of a purebred dairy sire, based on one or more of the factors type or appearance, pedigree, and character of offspring, is discussed. In addition the evaluation of milk and butterfat records and breeding terms, practices, and fallacies are considered.

Care, feeding, and management of the dairy sire, A. C. RAGSDALE and W. GIFFORD (*Missouri Sta. Bul. 275 (1929), pp. 14, figs. 6*).—The system of care, feeding, and management which will result in a young dairy bull attaining his

full size and best development as an individual, and the feeding, provisions for exercise, and suitable arrangements for housing with convenience and safety the mature bull are discussed.

Comparison of native with grade and purebred cows, D. W. MAY (*Porto Rico Sta. Rpt. 1928, p. 4, fig. 1*).—In this study it was found that in the station herd native cows produced an average of 2,953 lbs. of milk per year, half-bred Guernsey cows 4,344 lbs., and three-quarter Guernsey cows 4,928 lbs. of milk.

[Calf studies at the California Station] (*California Sta. Rpt. 1929, p. 59*).—The studies with dairy calves on a diet of concentrates alone have shown that the formation of hair balls in the stomachs and the development of emaciation are limiting factors in the ability of animals to thrive on such diets.

VII. The udder as a possible source of thermophilic bacteria, P. A. HANSEN (*New York State Sta. Tech. Bul. 158 (1929), pp. 14*).—Continuing this series of studies (E. S. R., 62, p. 373), milk was drawn aseptically from 118 cows in 5 herds, one sample being taken from each quarter of the udder. In all, 836 samples of milk were examined. The samples were plated on a special medium and were incubated at 56 or 62° C. Cultures were isolated from the colonies which developed and were tested to determine their ability to grow at a pasteurizing temperature of 62°.

Of the 16 cultures that grew at the pasteurizing temperature, 2 were Actinomyces and 14 were facultative thermophilic bacilli. In only one case were thermophiles drawn from the same cow in successive visits, and in no case were duplicate cultures obtained from the same quarter in successive visits. Organisms similar to those obtained from the milk cultures have been isolated from feed, dust, soil, and manure by other workers, and it is considered that the organisms obtained in this study were dust and air contaminations. Based on these results, it is concluded that the udder is not a source of thermophilic bacteria.

[Experiments in dairying at the California Station] (*California Sta. Rpt. 1929, pp. 65-68*).—Studies by C. L. Roadhouse and G. A. Koestler showed that normal milk which was relatively high in lactose and relatively low in chloride usually had a sweet, pleasing taste, while milk in which the proportion of lactose and chloride was reversed had an unpleasant and often an astringent or salty taste.

Roadhouse and J. L. Henderson determined that the addition of molasses in amounts up to 6 lbs. daily to a basal grain and alfalfa ration did not increase the lactose content of the milk, and that adding sodium chloride in amounts up to 3.6 oz. daily did not increase the chloride content of the milk abnormally. The lactose and chloride content and taste of milk were not changed by feeding up to 10 lbs. of raisins per day.

To determine the effect of oat and alfalfa hay on the lactose content of milk, two cows were fed alternate rations of the hays. While oat hay did not increase the lactose content of the milk, the milk produced during the period when the cows received this hay had a pleasing taste. Milk produced when the cows were on alfalfa hay had a noticeable feed flavor. These results indicated that some constituents other than the carbohydrates of oat hay produced the pleasing taste.

In a survey by Roadhouse, Henderson, and S. F. Aichholz of the taste of milk from each of 536 cows, scored on the sixth and thirtieth hour after being drawn, it was shown that 12.9 per cent of the cows produced milk with abnormal taste. Of these cows, 6.34 per cent produced milk with a salty taste, 3.17 per cent with a rancid taste, and 3.36 per cent with other abnormal tastes. Milk from 15 cows tasted rancid after 30 hours, but this flavor was not noticed at 6 hours.

Roadhouse and Aichholz found that milk exposed in clear glass bottles to the rays of the sun for 45 minutes developed a definite cappy or cardboard flavor, and that exposure of even 10 minutes produced a slight offtaste. Milk in amber colored glass and in paraffined paper containers was not affected by the sun. Milk absorbed heat faster in the amber colored than in the clear glass bottles, while the milk in the paper containers absorbed heat slowly. Pint samples exposed for 4 hours in the respective containers had temperatures of 109, 99, and 91° F.

The conclusions drawn from a study by Guthrie, Roadhouse, and G. A. Richardson (E. S. R., 60, p. 865) were that milk held at pasteurizing temperatures for 1.5 hours in contact with copper or any of its alloys will, after 2 or 3 days' storage, develop a definite cappy or cardboard odor and taste. A chemical analysis of such milk also showed the presence of copper.

Richardson and Abbott have found that the stiff body of butter resulting from winter feeding conditions (E. S. R., 59, p. 773) may be overcome by increasing the temperature of churning.

C. A. Phillips found no definite relation between the pH concentration and the titrable acidity of whey at the time of cutting the curd in the acid-curd method of preparing cottage cheese. The pH value varied from 4.29 to 4.37, while the titrable acidity varied from 0.548 to 0.565 per cent.

The creaming of raw and pasteurized milk, A. C. DAHLBERG and J. C. MARQUARDT (*New York State Sta. Tech. Bul.* 157 (1929), pp. 80, pls. 4, figs. 5).—Continuing this study (E. S. R., 60, p. 571) of the causes for irregularities produced by pasteurization on the cream layer volume of milk, an attempt was made to determine a fair average value for the cream layer volume which forms on raw milk and to discover those treatments which affect the creaming properties before the milk is delivered to the milk plant. Briefly summarized, the results of the study show that in order to obtain the maximum cream layer volume on pasteurized milk of a given fat content, it is necessary that the following points be observed:

"(1) The fat globules should be retained in their normal condition by prevention of excessive churning, agitation, freezing, or oiling off. (2) Pasteurization should be slightly less than 145° F. for a holding period of 30 minutes. (3) Milk should be cooled by a surface tubular cooler to 40° or below and bottled immediately. (4) The milk should be sold in 2 to 6 hours after bottling, as the cream layer volume shrinks on standing. (5) The milk should be held at 40° or below, for the cream shrinks in volume very markedly at 50° or above.

The removal of the bitter flavor from "bitterweed" cream, M. B. MACDONALD and A. GLASER (*Tennessee Sta. Circ.* 26 (1929), pp. 2).—In this publication the authors describe a method of removing the bitter substances from the cream produced by cows that have been eating bitterweed (*Helenium tenuifolium*). The method consists of separating the "bitterweed" milk in the usual way, adding uncontaminated sweet skim milk to the cream, and again separating it. Water may be used if good skim milk is not available, but is objectionable because it gives the cream a watery taste. The flavor and butter-making quality of cream handled in this manner should not differ from those of cream from good milk. It is also possible to remove the bitter substance from cream by hand skimming when a separator is not available.

While thorough washing of butter made from bitterweed cream may remove all the bitter substance, unless great care is taken to work the butter thoroughly it will contain bitter spots or streaks. No method has been found to make the bitter skim milk usable for food, but the curd may be washed free of most of the bitter substance, and the same is true of milk sugar prepared from the whey.

Equipment for city milk plants, C. E. CLEMENT and F. M. GRANT (*U. S. Dept. Agr. Circ. 99* (1929), pp. 36, figs. 18).—The equipment used in city milk plants is described, and the advantages and disadvantages of different types of equipment are discussed in this publication. The equipment required for various-sized plants and the approximate cost of such equipment is outlined.

VETERINARY MEDICINE

Handbook of physiology, W. D. HALLIBURTON and R. J. S. McDOWALL (*London: John Murray, 1928, 18. ed., rev., pp. [XXIV] +902, pls. 3, figs. 509*).—This is a completely revised edition of a standard work on physiology, dealing with the subject in 65 chapters.

Bacteriology, especially determinative bacteriology.—Vol. Ia, Parts A, B, Technique and general determinative bacteriology, K. B. LEHMANN and R. O. NEUMANN, trans. by R. S. BREED (*New York: G. E. Stechert & Co., 1930, 7. ed., rev., vol. Ia, pts. A, B, pp. VIII+103, pls. 5, figs. 3*).—This is an English edition of the first part of volume 1 of this work, previously noted (*E. S. R.*, 59, p. 273).

The use of iodine and its compounds in veterinary practice, H. A. REM (*London: De Gruy & Co., [1929], pp. 88*).—Following an introduction the subject is dealt with under the headings of iodine used externally; iodoform; lipiodol; iodine used internally; specific diseases amenable to treatment by iodine or its compounds, including actinomycosis, botryomycosis, abortion, foot-and-mouth disease, acute infective disease of swine, infectious catarrh of equines, strangles and pneumonia, joint-ill or navel-ill, distemper, hemorrhagic septicemia, epizootic lymphangitis, bacillary white diarrhea, and fowl pox and roup; iodine and general diseases; diseases due to mineral deficiencies; diseases of undetermined origin; iodine as a parasiticide; the influence of iodine in nutrition; iodine and reproduction; and disease resistance. A bibliography of 89 references to the literature is included.

[**Report of work in animal pathology at the California Station**] (*California Sta. Rpt. 1929, pp. 105-108*).—Reference is first made to studies of anaplasmosis by W. H. Boynton, accounts of which have been noted (*E. S. R.*, 62, p. 561).

Continued studies of the effect of vaccinating calves and pigs against tuberculosis with B. C. G. (*E. S. R.*, 61, p. 369) have shown that the immunity conferred by the subcutaneous, intravenous, intradermic, or oral methods of administration is not sufficient to justify the use of the vaccine on cattle or swine in regions where measures designed to eradicate tuberculosis in cattle are being carried out. However, in regions where no effective control measures are being used and eradication seems to be hopeless for many years in the future, the vaccine may be found eventually of economic value to cattle owners in preventing the occurrence of extensive or fatal lesions and limiting the spread of the disease.

Further studies by Traum of lymphangitis of acid-fast skin infections in cattle (*E. S. R.*, 61, pp. 270, 370) failed to throw more light on the identity of the inciting cause or causes of the various conditions grouped under these headings.

In a continuation and enlargement of the studies of the carrier problem in infectious abortion (*E. S. R.*, 61, p. 567; 62, p. 262) C. M. Haring, Traum, and Henry have shown that of 122 cows with an agglutination titer of over 1:50, 68 per cent eliminated *Brucella abortus* in their milk. Of 36 cows whose blood serum showed agglutination of 1:25 or 1:50, 1 was proved to be discharging

the organisms in the milk. Of 214 cows whose serum failed to agglutinate in dilutions of 1:25 or lower, only 2 were found to eliminate *B. abortus* in the milk. A correlation of the agglutination titer of milk sera with that of blood sera in 135 cows has thus far failed to show any cases in which there was agglutination with the milk serum when the blood serum was negative. On the other hand, five blood sera gave an agglutination of over 1:50 in which there was no agglutination with milk sera. The lowest dilution used in the latter was 1:12.5. In general, the cows with high agglutinating blood sera had a correspondingly high milk sera titer. With few exceptions, however, the milk sera titers were lower than that of the blood sera. A correlation between cows eliminating the organism in the milk and their milk serum titers indicated that the animals with a milk serum titer of 1:12.5 or more eliminated the organism in 69.2 per cent of cases. Of these, 90 per cent had a titer of more than 1:50, while 69 per cent of those not eliminating the organism in their milk had a titer of less than 1:50. Two cows with completely negative milk serum titers were found to be eliminating *B. abortus* organisms in their milk. One of these gave also a negative blood test, and the other's blood serum titer was 1:25.

An improved treatment for foot rot in sheep and certain specific necrotic and hyperplastic formations in swine was devised by J. A. Howarth. Spirochetes were found to be the etiological factor in the swine cases.

The subcutaneous and the feather follicle infection methods of vaccination for fowl pox were found equally satisfactory. In experiments by J. R. Beach with chemicals other than the usual 0.5 per cent phenol as a preservative for chicken pox vaccine, it was found that 0.1 per cent formalin, 1 per cent liquid chloroform, and the passage of chloroform vapor through the vaccine for varying periods of time rapidly destroyed the virus and were therefore unsuitable for use as preservatives for vaccine.

In studies by Beach and Michael, bacterial cell solution pullorins (E. S. R., 62, p. 471) were found very promising in the diagnosis of *Bacterium pullorum* infection of fowls and were in close agreement with the results of the post-mortem and bacteriological examinations of the fowls tested.

Report of the parasitologist, H. L. VAN VOLKENBERG (Porto Rico Sta. Rpt. 1928, pp. 36-38).—A general survey of the occurrence of parasites of animals in Porto Rico is briefly presented.

Five of six native pigs purchased at a local market succumbed to infection with *Balantidium coli* within a period of two weeks. That the snail *Lymnaea cubensis* is the intermediate host of the liver fluke *Fasciola hepatica* was demonstrated both by infesting this snail with the miracidia developed from the ova of the fluke and by infesting calves and rabbits with the resulting encysted cercariae. This snail occurs in mud in swampy land and along shallow sluggish streams and drainage ditches. *L. cubensis* and the snail *Planorbis quadeloupensis*, which transmits the blood fluke, *Schistosoma mansoni*, in man, were found to have similar habitats. Examination developed the fact that a very high percentage of *P. quadeloupensis* was infested with cercariae of five different kinds, the one which encysts on fish being by far the most common. In the experimental treatment for liver flukes in 800-lb. oxen large single doses of carbon tetrachloride (50 and 100 cc.), tetrachlorethylene (50 cc.), and carbon disulfide (20 cc.) apparently had no effect whatever in destroying them. Daily small doses, however, have shown some efficiency. In one case 10 cc. of carbon tetrachloride daily over a period of 20 days destroyed all the flukes in a heavily infested animal.

In studies of the swine kidney worm (*Stephanurus dentatus*) the ova were found to hatch in from 36 hours upward, the larva reaching the infective stage

in four or more days after having molted twice. The length of time between infestation and occurrence of ova in the urine was found to be about 6 months.

Further studies were made of the swine hookworm (*Necator suillus*) (E. S. R., 60, p. 774), only 1 lightly infested intestine having been found during the year of the 310 that were examined.

Report of the veterinary director general for the year ending March 31, 1929, G. HILTON (*Canada Dept. Agr., Rpt. Vet. Dir. Gen., 1929, pp. 56*).—Included in the author's report (E. S. R., 61, p. 174) are those of the Contagious Diseases Division, by A. E. Cameron (pp. 13-30), the Pathological Division, by E. A. Watson (pp. 30-39), and of The Meat and Canned Food Division, by R. Barnes (pp. 51-56). Discussions of Tuberculosis and Research Problems, with Particular Reference to "B. C. G. Vaccination," by E. A. Watson (pp. 40-47), Infectious Bronchitis of Fowl (A Brief Note on Symptoms and Control of the Disease), by C. H. Weaver (pp. 48, 49), and Influenza of Cattle, by E. A. Bruce (p. 50), are included in appendixes.

[**Report of Health of Animals Branch of Canada**], W. R. MOTHERWELL (*Canada Min. Agr. Rpt., 1928-29, pp. 44-51*).—This report (E. S. R., 61, p. 371) first deals with the occurrence of and work with infectious diseases of the year, and is followed by a brief account of animal disease research work.

Report on the Civil Veterinary Department, Burma (including the Insein Veterinary School), for the year ended the 31st March, 1929, A. MCKERRAL (*Burma Civ. Vet. Dept. Rpt. 1929, pp. [5]+5+1-21+3+23-32, pls. 4*).—This report (E. S. R., 61, p. 174) includes an account of the occurrence of infectious diseases of livestock and control work, including preventive inoculation conducted during the year.

A study of the comparative agglutinating properties of different strains of A. abortus (Bang), H. R. BAKER and C. C. PALMER (*Delaware Sta. Bul. 162 (1929), p. 22*).—In comparative tests made of 36 strains of the abortion organism obtained from different laboratories and a culture freshly isolated from the milk of an aborting cow, both the slide and tube methods were employed. The results showed that (1) certain laboratory strains were more antigenic than others, (2) the most antigenic strains were those which had been originally isolated from the fetuses of aborting cows, and (3) the freshly isolated strain was not as antigenic as strains which had been growing numerous generations upon laboratory media.

Fermentation of monosaccharids by organisms of the abortus-melitensis group, M. B. COLEMAN, H. H. OWEN, and H. G. DACEY (*Jour. Bact., 19 (1930), No. 1, p. 34*).—This is the authors' abstract of a contribution presented at the thirty-first annual meeting of the Society of American Bacteriologists.

It is pointed out that previous observers have not recorded the fermentation of carbohydrates by organisms of the abortus-melitensis group, although a few have reported that small amounts of glucose may be utilized by some strains. While studying the characteristics of this group at the research laboratories of the New York State Department of Health the authors found that acid production from certain monosaccharides might be demonstrated in a medium containing serum. Thirty-nine strains were tested, 21 of which were of bovine, 12 of human, 4 of porcine, 1 of caprine, and 1 of unknown origin. Arabinose was fermented by all of the strains, and xylose by all except one. The results with glucose, levulose, and galactose varied. No reaction was obtained with any of the strains in medium containing rhamnose.

The examination of 2,433 human sera for agglutinins of Brucella abortus, M. F. WELSH (*Jour. Immunol., 17 (1929), No. 3, pp. 285, 286*).—This is a report of tests made of 2,433 human sera that had been received by the Mary-

land State Board of Health from various parts of the State for routine Wassermann examination. Of the total group 5.46 per cent showed some reaction to the *B. abortus* antigen.

The examination of samples of porcine blood for *Brucella abortus* agglutinins. R. A. BOAK and C. M. CARPENTER (*Jour. Bact.*, 19 (1930), No. 1, p. 33).—This is the authors' abstract of a contribution presented at the thirty-first annual meeting of the Society of American Bacteriologists, held from December 30, 1929, to January 1, 1930, at Ames, Iowa.

Agglutination tests for *B. abortus* infection were made on approximately 4,000 samples of pig's blood collected in abattoirs from various parts of New York State. A large percentage of these pigs had been shipped from the Middle West, principally from the States of Missouri, Iowa, Minnesota, Illinois, Indiana, and Ohio. A very low incidence of infection was found as determined by the agglutination test, and the samples of blood collected from New York State hogs showed no more infection than those from the Middle West.

Bovine infectious abortion: Progress of control work. L. F. RETTGER and J. G. McALPINE (*Amer. Soc. Anim. Prod. Proc.* 1928, pp. 56-59).—This is a contribution from the Connecticut Storrs Experiment Station dealing with work noted from another source (*E. S. R.*, 60, p. 577).

Comparative values of anti-anthrax serum and of neosalvarsan in the treatment of experimental anthrax. T. J. KUBOTCHKIN and H. A. RETMANN (*Jour. Infect. Diseases*, 46 (1930), No. 1, pp. 36-41).—The work conducted led the authors to conclude that specific immune serum is of no value in treating experimental anthrax infections in mice, guinea pigs, or rabbits. Neosalvarsan is also of no value in the treatment of anthrax infection in mice and rabbits according to the technic used, but is apparently of distinct therapeutic value in guinea pigs when injected simultaneously with ordinarily fatal doses of anthrax bacilli.

Economic benefits of eradicating tuberculosis from livestock. J. R. MOHLER, A. E. WIGHT, and L. B. ERNEST (*U. S. Dept. Agr., Misc. Pub.* 66 (1929), pp. 24, figs. 8).—Official data relating to economic features are presented, together with reports of stock owners and public officials.

***B. welchii* as the cause of black-quarter in sheep.** A. D. McEWEN (*Vet. Rec.*, 10 (1930), No. 4, pp. 71, 72).—In work at the Research Institute of the Royal Veterinary College at London *Bacillus welchii* was found to be the cause of blackleg in sheep, its identity having been established on morphological grounds, cultural and fermentation tests, pathogenicity, and the neutralization of the pathogenic action of the bacilli by an immune serum.

A note on the occurrence of *Hypoderma crossi* in goats in Baluchistan, and the question of the fitness of the meat for human consumption. C. DAVENPORT (*Roy. Soc. Trop. Med. and Hyg. Trans.*, 23 (1930), No. 4, pp. 425, 426).—In November, 1927, goats supplied to troops in Quetta, Baluchistan, showed a very general and heavy infestation with cutaneous myiasis. Upon examination about 90 per cent proved to be infested with *H. crossi*, many showing as high as 50 lesions each. Since the carcasses of the goats were clean in every way, under the circumstances no alternative remained but to pass them as fit for human consumption.

Studies on the dissociation of the hog cholera bacillus, III. C. P. LI (*Jour. Expt. Med.*, 50 (1929), No. 6, pp. 767-775).—This third contribution (*E. S. R.*, 62, p. 170) deals with active immunization with R forms.

The blood in hog cholera. P. A. LEWIS and R. E. SHOFF (*Jour. Expt. Med.*, 50 (1929), No. 6, pp. 719-737).—"Prolonged and systematic examination of blood from swine with hog cholera has failed to reveal any formed element that could be identified with the etiological virus. Culture has likewise been

unsuccessful. The quantitative blood changes in hog cholera consist in a slowly progressive anemia, usually moderate in degree, and a rapidly progressive severe leucopenia affecting cells of the polymorphonuclear series most markedly but also including those of the lymphocytic series. Incubation of hog cholera blood results in a further progress of the leucopenia, in vitro, if heparin has been used as the anticoagulant, but there is no significant change if potassium oxalate or sodium citrate has been used.

"Consideration of the leucocytic reactions prevailing in experimental infection with *B[acillus] suisepeticus*, in infectious enteritis, in swine influenza, following successful immunization against hog cholera, and following infection of cholera sick swine with secondary invaders indicates that the leucocyte count would be of no aid in the differential diagnosis of hog cholera."

The life history of the swine kidney worm, B. SCHWARTZ and E. W. PRICE (*Science*, 70 (1929), No. 1835, pp. 613, 614).—The studies reported have definitely established the fact that most, if not all, cases of so-called parasitic livers contain lesions that have been produced by *Stephanurus dentatus*.

The relation between "grass disease" of horses and botulism, A. B. WALKER (*Brit. Jour. Expt. Path.*, 10 (1929), No. 6, pp. 352-360).—In work conducted by the department of pharmacology of the University of Edinburgh, eight horses were poisoned by oral administration of filtered cultures of *Bacillus botulinus*. The minimal lethal dose by the mouth of culture type B was about 0.01 cc. for a horse of 500 lbs. The hypodermic minimal lethal dose of this culture for a mouse of 28 gm. and for a guinea pig of 250 gm. was 0.0001 cc.

It was found that the symptoms produced by botulism in horses are quite different from those produced by grass disease, and some of the clinical symptoms which are apparently the same in the two diseases are probably due to different causes. The post-mortem findings in the two diseases were also found to be quite different. Parasympathetic paralysis, one of the chief symptoms of grass disease, does not occur in equine botulism.

A rare sequela to mercuric iodid treatment in equine epizootic lymphangitis: Orchitis, L. M. YUTUC (*Vet. Med.*, 24 (1929), No. 12, pp. 508-510, fig. 1).—The author has failed to obtain any favorable action from the administration of potassium iodide in treating epizootic lymphangitis. It is pointed out that orchitis and hydrocele may in rare cases be a sequela of the treatment.

Transmission of fowl-pox by mosquitoes, I. J. KLIGLER, R. S. MUCKENFUS, and T. M. RIVERS (*Soc. Expt. Biol. and Med. Proc.*, 26 (1928), No. 2, pp. 128, 129; *abs. in Rev. Appl. Ent.*, 17 (1929), Ser. B, No. 12, pp. 241, 242).—This is a brief but earlier account of the authors' findings than that previously noted (*E. S. R.*, 61, p. 274).

Transmission of fowl-pox by mosquitoes.—Further observations, I. J. KLIGLER and M. ASHNER (*Brit. Jour. Expt. Path.*, 10 (1929), No. 6, pp. 347-352, pl. 1).—This is a report of work conducted in continuation of that previously noted (*E. S. R.*, 61, p. 274).

It has been found that the same infected insect may produce a number of consecutive infections over a period of at least 16 days, and that feeding on another animal species does not impair the infectivity of the insect. The virus appears to be localized on the proboscis. Infection may be produced readily by the inoculation of the proboscis from 16 to 19 days after the insect has become infected, but only rarely by the inoculation of any other part of its body. The virus of fowl pox behaves in the same manner on infected silver pins as it does on the insect's proboscis.

Fowl pox is successfully prevented by new vaccination methods, W. T. JOHNSON (*Farm Jour.*, 53 (1929), No. 8, pp. 28, 37, 38, figs. 3).—This account is based upon work conducted in Oregon, in which State 80,000 fowls were

successfully vaccinated in the three years ended with 1928. It is pointed out that in all instances vaccination has been at the request of the poultrymen, many of whom had failed utterly in coping with the problem.

Piropasmosis in the domestic fowl caused by *Egyptianella pullorum* (second note) [trans. title]. M. CARPANO (*Ann. Parasitol. Humaine et Compar.*, 7 (1929), No. 5, pp. 365, 366).—These notes supplement the account previously noted (*E. S. R.*, 62, p. 566).

On the serological diagnosis of pullorum disease in domestic fowls: The chemical nature and the mechanism of the "cloudy" reaction, G. VALLEY and E. P. CASMAN (*Jour. Bact.*, 19 (1930), No. 1, pp. 36, 37).—This is the authors' abstract of a contribution presented at the thirty-first annual meeting of the Society of American Bacteriologists on studies of the so-called cloudy or false reaction by analytical and simulative synthetic methods.

"It was observed that in the agglutination tubes which showed the clouding or 'false' flocculation the H-ion concentration was invariably increased in direct relation to the volume of opalescent serum added to the tube; i. e., the tubes containing 1 to 50 dilution of serum were always of lower pH than those containing 1 to 100 dilution. The magnitude of suppression varied. The 'cloudy' reaction was prevented by adjusting the agglutination antigen to pH 8.5. The flocculent material which was separated from the tubes exhibiting the 'cloudy' reaction was positive to the biuret and xanthoproteic tests. Upon drying, a yellowish brown, waxy mass was obtained which gave the usual fat test (oily spot) on paper. The presence of fat was further indicated by a positive acrolein test. The dry material was fractionated by ether-alcohol extraction. The ether-alcohol insoluble residue was found to contain from 14 to 15 per cent nitrogen. The ether-alcohol extract was further separated into two fractions: Acetone-soluble (fat and cholesterol) and acetone-insoluble (lecithin and small amounts of galactolipins).

"Synthetic studies in a system containing fowl serum, pullorum antigen, and known quantities of fowl fat and lecithin showed that a complex resembling very closely the so-called 'cloudy' precipitate could be obtained in antigen, serum, and lecithin mixtures, either with or without fat. With serum, antigen, and fat combination, without lecithin, the precipitate obtained was not typical. It appears, then, that the so-called 'cloudy' reaction is due to the formation of a complex consisting of lipins and serum proteins, fat as such entering into the production of 'cloud' as a result of adsorption. The cloudiness and the increased acidity are apparently directly proportional to the amounts of opalescent serum used. It is, however, not evident that this acidity is the primary cause of the 'cloudy' precipitation, although it is one of the contributing factors which render the conditions more nearly optimal for precipitation of protein-lipin complexes in the agglutination tube.

"Evidence is presented to show that, aside from the metabolic changes accompanying egg laying, other factors, such as muscular exercise or shock, may influence the pH and the lipid content of the serum and consequently bring about the so-called 'cloudy' reaction."

Comparison of modified antigens for the avoidance of cloudy reactions in agglutination tests on fowl blood serum, W. L. BLEECKER and S. J. SCHILLING (*Poultry Sci.*, 8 (1929), No. 5, pp. 277-283).—In work at the Arkansas Experiment Station, comparisons were made of the frequency of occurrence of the nonspecific precipitation known as the cloudy reaction in the agglutination test for carriers of *Salmonella pullorum* when an unmodified antigen was used simultaneously with antigens containing, respectively, 0.04 per cent sodium hydroxide, 1.8 per cent and 5 per cent sodium chloride, and 0.1 per cent formalin.

The cloudy reaction was encountered on all antigens used. The 0.04 sodium hydroxide antigen reduced the total cloudy reactions, but appeared to be of greatest value in altering the type of nonspecific precipitates and caused a diffuse clouding to appear in place of flocculent clouding, which latter is probably the more serious type of interference. Thus, the incorporation of sodium hydroxide into antigen appeared as a definite improvement. In the authors' tests the addition of formalin to antigen appeared to be of some value, but did not give as satisfactory results in suppressing the cloudy reaction as were obtained with the other modified antigens used.

Observations on testing for pullorum disease, C. A. BRANDLY (*Cornell Vet.*, 20 (1930), No. 1, pp. 41-45).—A practical discussion, contributed from the Kansas Experiment Station, which includes a practical plan for the eradication of pullorum disease in poultry flocks under supervision of a practicing veterinarian.

The infection of parasite-free chicks with intestinal protozoa from birds and other animals, R. HEGNER (*Amer. Jour. Hyg.*, 10 (1929), No. 1, pp. 33-62, figs. 3).—A somewhat extended report of experiments in which intestinal protozoa were fed to parasite-free chicks.

Infectious entero-hepatitis or "blackhead" of turkeys, T. M. DOYLE (*Jour. Min. Agr. [Gt. Brit.]*, 36 (1929), No. 4, pp. 349-352, pl. 1).—This is a practical account of blackhead of turkeys.

Diectophyme renalis, a little-known parasite of silver foxes, F. VOLKMAR (*Vet. Med.*, 24 (1929), No. 12, pp. 499, 500, figs. 2).—The author records the finding of a nematode parasite (*D. renale*) attached to the visceral surface of the liver in a silver fox raised near Minot, N. Dak. This is said to be the first record of the parasite having been observed in North Dakota, and probably also in the United States as regards its occurrence in domesticated silver foxes.

AGRICULTURAL ENGINEERING

[Miscellaneous agricultural engineering investigations at the California Station] (California Sta. Rpt. 1929, pp. 48-51).—Studies by H. L. Belton and J. E. Dougherty on the relation of temperature to poultry house design indicated that while roof insulation has some value in controlling temperature, controlled ventilation is more effective within feasible limits in regulating house temperatures. Effectively installed insulation and controlled ventilation appear to be factors which should be used in combination. A droppings board constructed away from the rear wall permits better air circulation with resulting lower temperatures during a breeze, but has little value on still evenings. Fan agitation of the air and roof sprinkling during hot weather appear to have little value. Electric heating, thermostatically controlled, for reducing dampness during winter weather showed some promise.

Laboratory tests by A. H. Hoffman of about 50 late model air cleaners for automotive engines showed efficiencies ranging from 100 per cent to less than zero. That is to say, some of the cleaners instead of protecting from dust because of their placing gather in and pass on to the carburetor more dust than would normally enter the properly placed open carburetor inlet. The restriction or vacuum effect is very low for many of the latest cleaners, producing no appreciable effect on carburetor action under normal conditions. Some cleaners tested increase rather rapidly in restriction under severe dust conditions. The most satisfactory cleaners are oily filter types. Road tests of the vacuum effect of 18 cleaners showed that none when new would normally affect carburetor action seriously at speeds under 35 or 40 miles per hour. From 40 to 60 miles per hour restriction effects increase very rapidly. Tests

made of dusts used by various air cleaner manufacturers to test the efficiency of their product showed large differences in floating and settling properties.

In studies by Hoffman of oil filters for crank cases, the wear on the piston rings of an engine unequipped with a filter was found to be about twice that of an engine equipped with a filter after a 10,000 mile road test. A study of normal engine wear in a modern tractor well protected against the entry of dust and provided with an oil filter was made in a 408-hour, 1,330-mile continuous run, and the wear was found to be exceedingly slight. The maximum was on the top piston rings, which averaged a loss in weight of 0.1867 gm., equivalent to 0.0759 per cent of the original weight. Most of the parts measured showed wear too slight to measure. A study of the dirt found in 25 used engine crank case oil filters showed that carbon rather than other solid foreign matter in the oil limits the useful life of such filters. The service of these filters ranged from 78 to 53,035 miles, with a normal of 10,000 miles. The solids other than carbon ranged as follows for the 25 filters: Silica 38.10 to 3.20 per cent, iron 80.25 to 47.84 per cent, lead 23.52 to 0.02 per cent, copper 7.38 to 0.80 per cent, with traces of tin, chromium, manganese, magnesium, zinc, and antimony.

B. D. Moses, J. R. Tavernetti, and Dougherty found in a study of the quantity of air and the humidity and temperature conditions required for the brooding of chicks that somewhere between 1 and 2 cu. ft. of air per minute are required for each 100 chicks. The studies also indicate that the carbon dioxide concentration with this quantity of air is not a factor in chick development, and that the chief function of fresh air is to supply oxygen, to regulate heat, and to remove moisture given off by the chicks.

E. J. Stirniman found in his study of the relation of temperature and moisture content variations to the checking of rice kernels that checking increased from approximately 20 per cent at time of binding to 60 per cent for portions of the shock exposed to the sun for 14 days. The unexposed portion of the shock showed an increase in checking of only 5 per cent.

[Irrigation investigations at the California Station] (*California Sta. Rpt. 1929, pp. 83-86*).—S. H. Beckett found that mature orange groves in the vicinity of Santa Ana, Tustin, and Anaheim have, under efficient irrigation practice and normal climatic conditions, a total seasonal irrigation requirement of 18 acre-in. per acre.

Beckett, H. F. Blaney, and C. A. Taylor found that in the irrigated citrus groves, when the available moisture has been exhausted from the unirrigated portions of the soil, there is no apparent increase in the rate of water extraction from the irrigated portions; also, that there is some evidence that the quantity of water used by citrus trees is dependent upon the percentage of soil mass moistened by irrigation.

M. R. Huberty concluded that on the deep soils of light texture, three irrigations totaling 18 acre-in. in depth will be sufficient to meet the moisture requirements of the average orchards of the Sacramento Valley, while a seasonal depth of 24 in. will meet the demands of the large, vigorous growing orchards. The average orchard growing on the deep silt loam soil will require a total depth of about 18 in. applied in two irrigations.

In investigations of the effect of irrigation on canning and drying peaches F. J. Veilmeyer and A. H. Hendrickson found that no measurable differences were produced in the fruit unless the soil moisture was reduced to about the condition at which plants permanently wilted, a condition which is termed the "permanent wilting percentage."

Substantial evidence was obtained by C. F. Dunshee of the control of early maturing types of water grass by continuous submergence. A three-year study

in the irrigation of cotton conducted at Shafter showed that where the crop is grown under soil-moisture conditions in which the plants are not allowed to wilt the total seasonal transpiration use of water averages 30 acre-in. per acre, and that under careful irrigation practice a seasonal depth of 36 in. of irrigation water is required to meet this demand. The results of flower counts show that when the soil moisture is reduced to about the permanent wilting percentage there is a marked effect on the number of flowers produced as well as on the time the plants reach the peak of the flowering period. The period of maximum use of water was found to be during the peak of the flowering period.

Studies by Veihmeyer and J. P. Conrad of root development in relation to soil moisture showed that if the soil is wet at the beginning of the growing season to the full depth to which roots of the plants would normally penetrate, subsequent additions of water, unless adverse conditions of growth are brought about thereby, can have little influence on the extent of root development.

The flow of water in riveted steel and analogous pipes, F. C. SCOBEEY (U. S. Dept. Agr., Tech. Bul. 150 (1930), pp. 136, pls. 6, figs. 10).—This bulletin brings together a large amount of engineering data from various sources on the carrying capacity of pipes made of steel and plate steel or iron as used in general service for the conveyance of water under pressure. Special attention is devoted to the results of field experiments by the author, made for the primary purpose of determining the proper capacity of pipes for the conveyance of water for irrigation use, it being pointed out that the laws thus developed apply equally well if the water is to be conveyed for power, domestic, or other use. Two appendixes contain abstracts of reports of experiments by others on the subject, and an extensive bibliography is included.

The thoroughness of the analysis of the available data is indicated by the characteristically pointed conclusions of the author. These indicate that there is a material difference in the carrying capacities of steel pipes. Other things being equal, the difference is due to the type of unit assembly and the field joints. Present indications, based on the performance of pipes of various ages, are that all iron and steel pipes lose capacity progressively when in use. The general term "riveted pipe" is insufficiently distinguishing for use in capacity specifications. Plate thickness, type and size of rivets, and method of making joints all have noticeable influence on capacity.

In irrigation use, where pipes are fed by canal water, extensive silt deposits may be expected unless scouring velocities are available. For velocities under about 5 ft. per second many of the irrigation pipes of diameters under 14 in. when tested showed marked lack of capacity compared with the same types of pipe under conditions which did not contribute silt deposits. No deterioration in capacity need be anticipated throughout the life of a pipe carrying water containing abrasive detritus at velocities above 10 ft. per second. It is quite probable that neither coating nor tuberculation could survive the erosion. However, the life of the pipe would be shortened by the scouring action.

The capacities of riveted steel and analogous pipes, when new, fit in with comparable categories of other materials to an extent that leaves little room for dispute. Future research and improvement should be directed toward the retention of the original capacity by preservation of the coating, which should protect the steel from chemical action regardless of the activity of the water or the structure of the steel. Loss of capacity caused by such natural barriers as debris or silt is common to all pipes, although plate offsets and rivet heads offer initial obstructions which tend to produce such accumulations in greater degree than in some other kinds of pipes, other factors remaining equal.

Assuming the capacity of full-riveted pipe with plate less than 0.5 in. thick as 100 per cent, then continuous-interior pipe without rivet heads will carry about 18 per cent more, and girth-riveted pipe, but continuous on the straight seams, will carry nearly 15 per cent more. With the same base, thin-sheet (gauge-metal) pipes with flat-head rivets will carry 8 per cent more; heavy plate pipe of cylinder or taper joints will carry about 4 per cent less; and heavy plate, butt-strap pipe will carry about 8 per cent less.

Surface water supply of the United States, 1925, I, III-V (*U. S. Geol. Survey, Water-Supply Papers* 601 (1930), pp. VI+269, fig. 1; 603 (1929), pp. VII+343, fig. 1; 604 (1929), pp. V+179, fig. 1; 605 (1929), pp. V+179, fig. 1).—Part 1 of these reports, prepared in cooperation with the States of Maine, New Hampshire, Massachusetts, New York, New Jersey, Maryland, and Virginia, presents the results of measurements of flow made on streams in the north Atlantic slope drainage basins during the year ended September 30, 1925. Part 3, prepared in cooperation with the States of New York, West Virginia, Ohio, Virginia, Illinois, Tennessee, North Carolina, and Alabama, presents corresponding measurements for the Ohio River Basin; part 4, prepared in cooperation with the States of Wisconsin, Illinois, Ohio, and New York, corresponding measurements for the St. Lawrence River Basin; and part 5, prepared in cooperation with the States of Minnesota, Wisconsin, Iowa, Illinois, and Missouri, corresponding measurements in the Hudson Bay and upper Mississippi River Basins.

Public Roads, [January, 1930] (*U. S. Dept. Agr., Public Roads, 10* (1930), No. 11, pp. 193-212+[2], figs. 14).—This number of this periodical contains the status of Federal-aid road construction as of December 31, 1929, together with an article on Bituminous Surface Treatment of Sand-Clay and Topsoil Roads (pp. 193-212).

Progress report on the use of the combine in South Dakota, G. LUNDY, K. H. KLAGES, and J. F. GOSS (*South Dakota Sta. Bul.* 244 (1929), pp. 63, figs. 24).—This report deals with studies which were conducted partially in cooperation with the U. S. Department of Agriculture. The area around Blunt in Hughes County was selected in 1927 as a basis for the study because in this area there were a considerable number of combines in operation. During 1928 the field of work was extended to include Sully and Potter Counties. In both years data were also obtained around Brookings, where a combine was operated for experimental purposes.

The number of combined harvester-threshers has increased rapidly, especially in the central and western parts of South Dakota, 648 machines being on record in 1928.

Moisture determinations made during the harvesting season of 1927 indicated a tendency for combine operators to cover too large an acreage with one machine. This attempt to harvest extremely large areas with one machine led to the practice of harvesting too early in the season, too early in the mornings while the grain was still damp with dew, or too early after rainy periods. Samples of combined wheat, barley, and oats collected in 1928 showed a greater variation in moisture content than binder-harvested samples. In the case of the combined samples of wheat 43.6 per cent contained 15 per cent or a higher percentage of moisture, as compared with 26.1 per cent of the binder-cut samples. On the other hand only 22 per cent of the binder-cut samples contained less than 13 per cent of moisture, while 35.8 per cent of the combined samples fell into this low moisture group. This shows that wheat of low moisture content can be obtained by the use of the combine.

The samples collected in 1928 likewise showed very definitely that many combine users started their machines too early in the season, before the grain was sufficiently dry for harvesting. They also showed a decided tendency for producers to resume harvesting operations too soon after rainy periods, before the grain is dry enough. The high moisture contents of a large percentage of the combined samples are reflected in the commercial grades of these samples. Of the samples of combined wheat 37.7 per cent graded No. 1, as compared with 48 per cent of the binder-cut samples. On the basis of experiments performed in eastern South Dakota it is not there advisable to start combining earlier in the morning than 11 o'clock except on very dry days. In some cases, as in weedy fields, it was found that grain sufficiently dry to be handled with safety could not be obtained except by delaying cutting until the middle of the afternoon. The moisture content of grains increases toward evening, but on most dry days it was found that it was safe to carry on harvesting operations until 8 p. m. As regards the time of the season to begin combining direct, farmers themselves reported that this should begin between 10 and 14 days later than the beginning of the binder harvest. On the other hand, windrowing could begin at the same time as the binder harvest, but the grain should dry in the windrow about 5 days before combining with the pick-up attachment.

The most profitable moisture condition was about 13.5 to 14 per cent. At this point the wheat had the greatest weight of moisture consistent with safe storage, and the price was best. In the case of barley and flax it was also found that the gains from drying were not as large as the spread in price between wet and dry grain. The cost of harvesting and threshing large acreages was found to be lower with the combine than with the binder or header and stationary threshers.

The results available from various investigations indicate that harvesting losses are largest with the binder, lower with the header, and lowest with the combine. The combine is less efficient as a thresher than the stationary separator, but taken as a whole the losses with the combine were found to be only about 60 or 70 per cent as great as with the binder and separator.

Data are presented also on market discounts for combined wheat, the relative costs of harvesting by combine and other methods, and on artificial drying. A list of publications on combining is included.

An economic study of farm electrification in New York, with a discussion of rural electrification in the Provinces of Quebec and Ontario, Canada, R. F. BUCKNAM (*New York Cornell Sta. Bul.* 496 (1929), pp. 65, fig. 1).—This bulletin reports data on the uses, costs, and possibilities of electricity on New York farms. Data are also included on rural electrification in the Provinces of Quebec and Ontario, Canada, and a comparison is given of the net cost of electricity in Ontario Province and in New York State. Copies of questionnaires used are appended.

Ventilating investigations (*New York Cornell Sta. Rpt.* 1929, pp. 64, 65).—In preliminary barn ventilation experiments it was found possible, by use of incoming fresh air for forming a blanket over the inner surface of the glass of a few windows, to keep a cow stable window entirely dry when the outside temperature is -5° F.

In poultry house ventilation studies no difference in egg production occurred between flocks housed in a standard Cornell house with open front and a specially insulated Cornell house equipped with a commercial ventilation system. The insulated house was a little warmer in cold periods but was more dusty than the open-front house.

RURAL ECONOMICS AND SOCIOLOGY

[Investigations in agricultural economics and farm management at the New York Cornell Station, 1928-29] (*New York Cornell Sta. Rpt. 1929, pp. 3-15*).—Results of investigations not previously noted are reported as follows:

An analysis of the milk supply of New York City from the standpoint of factors influencing total volume, volume per dairy, season of production, fat content, and grade, H. A. Ross.—Information was obtained in this study, begun in 1928 in cooperation with the New York Central Railroad Company, from milk dealers and cooperative associations supplying New York City with milk. The data covered a period of 21 years for 45 plants, 7 years for 260 plants, and short periods for others. Some of the facts indicated are that there has been a definite trend downward in the average fat content of fluid milk in the New York milk shed during recent years. A considerable quantity of milk is still going to manufacturing plants on railroads during the shortage period for fluid milk. Although the amount of milk produced per day per dairy has increased in recent years, the increase in November has not been so large as in June. The present plan of purchasing milk at the same price per 100 lbs., irrespective of seasonal variations in production, has resulted in a poorer adjustment of production to demand, with a greater relative surplus in the spring and an increasing shortage in the fall. The need for a larger supply of fall milk would seem to justify greater encouragement of winter dairying.

A study of the producing capacity of the New York milk shed through analysis of farm-survey records relating to systems of farming, volume and season of production, breeding and feeding practices, and marketing facilities, M. P. Catherwood.—From this study, begun in 1928 in cooperation with the New York Central Railroad Company, it appears that the kind of milk market is more important than the amount of pasture or other physical factors in influencing the intensity of dairying and the season of production of milk.

A study of the effect of soil, size of business, yields, and other factors on the profits of fruit farms, G. P. Scoville.—An additional 170 complete records of the year's business were obtained in Newfane Township, Niagara County, bringing the total to 2,235 in 15 years. Over a period of 14 years the average labor income of farmers on Dunkirk soils (good fruit soils) was \$468, as compared with \$78 on Clyde soils (poor fruit soils).

The cost of production of apples, T. E. LaMont.—Detailed information on the cost of producing apples from 129 orchards over 30 years of age in Newfane Township, Niagara County, was obtained. For 1926 the Dunkirk soils yielded 78 bbls. per acre at a net cost up to picking of 91 cts. per barrel, as compared with 37 bbls. per acre at a cost of \$1.66 per barrel on the Clyde soils.

An economic study of tractors on New York farms, C. W. Gilbert.—Detailed information was obtained in this study, begun in 1927, from 175 tractor owners representing 4 important types of farming. The average cost, not including wages of operators, was \$1.15 per hour for 70 2-plow tractors in 1919 and 72 cts. per hour for 103 such tractors in 1926. The decline was due principally to the decreased price of tractors and their greater reliability. The number of hours used was the most important factor affecting the cost per hour. The average cost per hour for 54 tractors used less than 200 hours per year was \$1.37, as compared with 64 cts. for 16 tractors used more than 600 hours per year.

An economic study of motor trucks on New York farms, C. W. Gilbert.—Detailed information on the cost of operation of trucks and the effect of trucks

on farm organization was obtained from 48 dairy farms and 49 fruit farms. A comparison with data from a similar study in 1920-21 showed a rapid increase in the use of trucks and a slight decrease in the average cost of operation. The average cost of operation of 70 farm motor trucks used for 3,863 miles in the earlier period was 10.2 cts. per mile, as compared with 9.2 cts. per mile for 31 similar trucks in 1926-27. The present study showed the average cost to be 43.1 cts. per ton mile for trucks used less than 500 ton miles per year, 7.6 cts. for trucks used for more than 4,000 ton miles, and 19.2 cts. per ton mile for all trucks included.

The marketing of milk through ice cream, M. C. Bond.—In this study, begun in 1927, complete records of the costs and returns from ice cream manufacture were obtained from 39 plants for the business year 1925 and from 59 plants for the business year 1926. The cost of milk products at the plants in 1926 ranged from 28 to 72 cts. per gallon of ice cream, averaging about 38 cts. About 73 per cent of the milk products used were obtained within New York. The remaining 27 per cent, except the butter, came chiefly from neighboring States.

Valuation of real estate with special reference to farm real estate, compiled by E. L. DAY (*U. S. Dept. Agr., Bur. Agr. Econ., Agr. Econ. Bibliog.* 29 (1929), pp. VI+87).—This mimeographed annotated bibliography includes 282 titles of books, articles, etc., published in the United States and classified under the following headings: Importance of the problem, rural valuation, forest and woodlot valuation, orchard valuation, irrigated land valuation, urban valuation and general methods, building valuation, railroad and public utility land valuation, land classification surveys, land valuation short courses and conferences, and assessors' manuals. Forty-eight titles of publications in foreign countries and the titles of 24 unpublished master's and doctor's theses are also included.

Studies in Vermont dairy farming.—VI, The position of northern Vermont among American dairy farming regions, J. L. HILLS (*Vermont Sta. Bul.* 307 (1929), pp. 32, fig. 1).—The data obtained by the U. S. Tariff Commission in the study previously noted (*E. S. R.*, 62, p. 482) for the 984 farms in 15 Northeastern and Mid-western States of the United States are analyzed, the farms being grouped in 11 areas. Tables are given showing, by areas, the land utilization per farm; investments for different purposes per cow; number of cows and animal units; amounts of different kinds of feed, pasture usage, and costs; labor expenditure per animal unit; production per cow; gross costs, credits, and net costs and returns per cow; and the income per farm from the dairy enterprise. The study showed the following for the northern Vermont area:

Farms were larger than in any other area studied except southeastern Vermont. Total investments in herds, buildings, and equipment were lower than in the other areas. More hay and less silage and grain (except in one area for each) were fed than elsewhere. Labor costs were less than in Wisconsin and the other areas east of Ohio. Relatively, herds were large and milk and butterfat yields low. Both total gross costs per cow and net returns per cow were less than in the other areas east of the Mississippi. Total income, including both cash and noncash items, was exceeded only by the southern New England and northern New York areas. From the data it appears that northern Vermont can probably meet the threatened western competition as long as or longer than other eastern areas.

This study is the sixth of the series previously noted (*E. S. R.*, 62, p. 282).

Effect of milk-plant arrangement and methods of operation on labor requirements, C. E. CLEMENT, P. E. LEFEVRE, J. B. BAIN, and F. M. GRANT (*U. S. Dept. Agr., Tech. Bul.* 153 (1929), pp. 40, figs 21).—This bulletin is based

on labor studies made in various sections of the United States of the operations in milk plants from the time the milk reaches the plant until placed on the wagons ready for delivery.

The different systems used in receiving the milk, checking in the routes, bottle washing and filling, pasteurizing and cooling milk, cleaning equipment, and stacking bottled milk in storage, and checking out the routes are described and compared as to the time and labor requirements. The relations between size of plant and number of stories in the plant and the labor requirements and the amount of labor used in plants in various sections of the country are also discussed.

The marketing of Delaware sweet potatoes, H. S. GABRIEL (*Delaware Sta. Bul.* 461 (1929), pp. 45, figs. 3).—Tables are given and discussed showing the extent of the sweetpotato industry and the time and destinations of shipments of sweetpotatoes produced in Delaware, the chief competing States, and the United States. Other subjects pertaining to the industry in Delaware discussed are the time growers sell their sweetpotatoes, terminal markets, marketing of seconds, methods of selling, inspections at points of origin and at destinations, and the propagation, diseases, harvesting, grading, and storage of sweetpotatoes.

Apple varieties: Prices, yields, and acreages, G. P. SCOVILLE and T. E. LAMONT (*New York Cornell Sta. Bul.* 495 (1929), pp. 104, figs. 21).—Tables, graphs, and maps are included and discussed presenting information regarding (1) wholesale prices of apples, by varieties, in New York City and the trends in such prices; (2) farm prices and the spread between farm prices and New York City wholesale prices, by varieties, 1922-1926, and the percentage of different varieties sold each month, 1923-24 to 1926-27, in the Newfane-Olcott area of Niagara County; (3) methods of marketing and prices, by method of sale and by type of package, in the Newfane-Olcott area, 1922-1926; (4) percentage of apples sold in each grade by varieties, 1922-1926, the yields of important varieties by age of trees, 1918-1926, and the returns per tree for different ages and varieties in the Newfane-Olcott area, 1922-1926; (5) the production, utilization, and transportation of the 1926 apple crop for the State of New York; (6) the varieties of apples grown in different sections of New York and other States or sections of the United States; and (7) the age of trees in the Newfane-Olcott district and in New York counties, by varieties.

Prices of North Dakota farm products, O. M. FULLER and R. E. WILLARD (*North Dakota Sta. Bul.* 232 (1929), pp. 51, figs. 23).—Tables are included showing (1) the prices received by North Dakota producers on the fifteenth of each month from January, 1910, to August, 1929, inclusive, for wheat, rye, flax, oats, barley, potatoes, beef cattle, hogs, sheep, lambs, wool, butterfat, chickens, and eggs; (2) index numbers of the above monthly prices; (3) monthly composite index numbers of prices of the 14 North Dakota farm products and of the prices of the crops and of the livestock and livestock products included; and (4) yearly index numbers, 1910-1927, of prices paid by farmers of the United States for commodities bought for family maintenance and for those to be used in production.

Graphs are presented and discussed for each of the 14 commodities showing the relation between the index numbers of the average annual prices, 1910-1928, and the index numbers of prices paid by farmers of the United States for commodities purchased.

Price cycles, seasonal changes in price, prices received by farmers in other States for butterfat, hogs, eggs, barley, and wheat compared with North Dakota prices, and the purchasing power of North Dakota farm products are also briefly discussed and illustrated by charts and tables.

"The purchasing power of North Dakota farm products in terms of commodities bought by farmers in the United States has not equalled 100 per cent since the war period. In 1925 it reached 96 per cent, but has decreased since that time."

Historical study of prices received by producers of farm products in Virginia, 1801-1927, A. G. PETERSON (*Virginia Sta. Tech. Bul. 37* (1929), pp. 218, figs. 46).—This study, made in cooperation with the U. S. D. A. Bureau of Agricultural Economics, brings together "available historical price data and such other related data as will be valuable to research workers in agricultural economics and extension workers and to teachers in the various fields of agriculture."

The numerous tables, which include data for periods of varying lengths, depending on the information available, cover a wide range of subjects, the more important of which are monthly and annual (crop year and calendar year) farm prices of the leading farm products; acreage, yield, and production of different crops; number and value of different kinds of livestock; wages of farm labor; value of farm lands and improvements; index numbers of prices of Virginia farm products; index numbers for the United States of wholesale prices of all commodities, nonagricultural commodities, and commodities purchased by farmers; prices of selected products for selected periods or in selected areas of Virginia; farm prices and index numbers of such prices of farm products on a gold basis, 1865 or 1866 to 1878; and other similar data. The index numbers of Virginia farm prices cover the period 1826-1927. The period 1909-1913 was chosen as a base, with the period 1922-1926 as a base period for quantity weights. The 31 farm products included during the base period were divided into 8 groups—grains, fruits and vegetables, tobacco, other crops, meat animals and products, a dairy group (milk cows, butter, and milk), chickens and eggs, and horses and mules, and index numbers computed for each group and for all the 31 products combined.

A brief history of the early development of agriculture, transportation, and markets in Virginia is given. The effects of the general level of prices, changes in production, supply, and demand, transportation costs, and tariffs and foreign competition on the prices of Virginia farm products are discussed, and graphs are included showing changes and trends in the prices of different products.

Agricultural outlook for Oklahoma, 1930, P. H. STEPHENS, J. T. SANDERS, O. W. HERBMAN, O. D. DUNCAN, and P. NELSON (*Oklahoma Sta. Circ. 76* (1930), pp. 20).—The present situation and the outlook for 1930 for agriculture in general and for cotton, wheat, dairying, poultry, hogs, beef cattle, sheep, horses and mules, feed grains and forage, broomcorn, strawberries, peanuts, and fruits and vegetables are discussed.

Rural organizations and the farm family, E. L. KIRKPATRICK, J. H. KOLB, C. INGE, and A. F. WILDEN (*Wisconsin Sta. Research Bul. 96* (1929), pp. [2]+56, figs. 3).—This study, made in 1927 and 1928 in cooperation with the U. S. Department of Agriculture, deals with the organization behavior of 282 farm families, including 924 individuals 10 years of age or over in 12 selected rural school districts in 5 counties of Wisconsin. The organizations considered included farmers' clubs; farm bureaus; equities; granges; lodges; dramatic, reading, card, and other clubs; and milk producers, marketing, and other similar associations. Official church, school, and local government administrative units were not included. All of the families were visited and, with few exceptions, a general schedule was filled out for each family or household, and also a schedule covering membership or affiliation, attendance, officership and support of organizations, and attendance at or participation in recreational activities was obtained for each person 10 years of age or over. Certain districts and families

were revisited for case studies. The 12 districts selected consisted of 6 high organization districts in which the number of organizations ranged from 12 to 25, averaging 18.7, and 6 low organization districts in which the number of organizations ranged from 8 to 14, averaging 10.7. Statistical and case analyses were used in the study.

A general analysis was made by type of district, extent of affiliation per family, and participation index of the organization situation in terms of organization affiliation, attendance at meetings, contributions, committee work, and officership on the basis of per family and per person. In the type of district analysis, 151 families with 469 individuals were in the 6 high organization districts and 131 families with 455 individuals in the low organization districts. In the extent of affiliation per family analysis, the 282 families were divided as follows: "100 per cent affiliation" group (each member of the family affiliated with one or more organizations), 80 families in the high and 16 families in the low organization districts; "medium affiliation" group (at least one, but not all members of the family, connected with some organization), 46 families in the high and 59 families in the low districts; and "zero affiliation" group (no member affiliated with any organization), 25 families in the high and 56 families in the low districts. In the participation index analysis, each member 10 years of age or over of the family was rated and the total rating divided by the number of persons rated to determine the participation index of the family, the following number of points being assigned to different types of participation: Each affiliation 100, each meeting attended 100, each contribution 100, each service on committees 25, and each office held 75. This system gave a rating of 1,000 points for the individual having about average participation. The indexes for the 201 families having affiliations ranged from 40 to 9,675 points per family, the average being 1,159 and the median 933 points. In making comparisons two groups were used—one of families (35) with indexes of 2,000 points or over, and one of families (42, not including those with zero indexes) with indexes of less than 400 points.

The relation of a considerable number of factors pertaining to the composition of the family, farm business resources, family living, educational and cultural facilities, and recreational and other activities to organization behavior were considered by type of district, extent of affiliation per family, and extent of participation per family. The suggested relations were checked by coefficients of gross correlation and of multiple correlation.

The statistical analyses showed the following as to the relations of different factors to organization behavior: The 40 or more factors analyzed seemed to be responsible for not more than 25 per cent of the total influence of all factors. Factors pertaining to educational and cultural facilities and activities bore the most significant positive relations. Distance from recognized trading center, type of road on which farm was located, and length of residence on present farm had little relation. On the whole, church affiliation and attendance had no relation. With few exceptions, size of family and age of members had practically no relation. Size of farm business resources bore little, if any, positive relation, the relation of number of acres cropped per farm being negative, and those of gross cash income from farming and from all sources bearing fairly significant positive relations.

The case method analysis appeared to confirm the statistical findings, and indicated that cultural traditions resulting from early settlement and nationality backgrounds were the most important factors, with neighborhood or community groupings next in importance. Other significant factors pertained to stimulation by suggestions, encouragement, and promotion from outside the district.

FOODS—HUMAN NUTRITION

[Fruit products] (*California Sta. Rpt. 1929, pp. 111-114*).—Studies by P. F. Nichols and H. S. Reed of the rôle of SO_2 and SO_3 in the preparation and storage of dried fruits have shown that sprinkling apricots before sulfuring retards, and dipping them in hot lye increases, the rate of absorption of SO_2 . Sulfuring apricots and prunes had little effect on their H-ion concentration. Dried fruits held at 65 to 70° F. for 6 months showed a decrease of about 50 per cent in SO_2 content, while fresh apricots held at 32° for 8 months lost about 25 per cent and those held at 0° about 15 per cent of their SO_2 content.

The addition of olive oil, coconut oil, mineral oil, or glycerin to the lye dip used in preparing bleached Sultanina raisins gave a gloss to the dried fruit, but did not protect it perfectly against insect infestation. Storage of prunes for 2 months at 32° prevented insect damage, but did not kill all forms of *Plodia interpunctella*.

Heavy irrigation was found to have no injurious effect on the canning quality of clingstone peaches.

Crushed pears canned in 1928 at one factory were found by Nichols to have corroded the cans, while samples canned by the same method in another cannery were in good condition. The H-ion concentration of the two products were pH 4.3 and 3.6, respectively. This is thought to confirm the discovery of E. M. Mrak in connection with prune canning that, other things being equal, increased acidity decreases the risk of corrosion.

Studies by G. A. Pitman of the composition of almonds showed little difference between imported and California almonds in content of hemicelluloses and suberin, as had previously been found by C. V. Hart to be true of other constituents. Shearing tests showed the California almonds to be slightly firmer than the imported. Almonds of the 1928 season from the Paso Robles district had a slightly higher average content of protein and slightly lower of oil than the same varieties from the Sacramento Valley. Further experiments by Mrak and P. H. Richert on the canning of prunes (*E. S. R.*, 62, p. 489) showed that swelling of the cans from the formation of hydrogen gas after canning is retarded by large head space in the can, the use of large cans, short blanching before canning, relatively high sugar concentration in the sirup, and the addition of fruit acid. No differences could be observed between sun-dried and dehydrated canned prunes in the rate of corrosion of the tin plate. Pits, kernels, skins, juice, and pulp canned separately all caused can corrosion. The rate of corrosion was most rapid in enamel-lined cans, followed by plain "coke" tin and "charcoal" plate tin. New uses of prune pulp developed included its use in a prune and cereal food containing over 70 per cent of prune pulp and in bread and Danish pastries.

In various studies of grape concentrates Richert found H-ion concentration to be an important factor in the rate of darkening. D. S. Glenn found that red concentrates crystallize much more slowly than white concentrates, the critical concentration at room temperature being at 60 to 70° Brix. It is recommended that grape table sirups be concentrated to not beyond 69°. H. B. Farley found that carbonated grape beverages do not require more than 0.025 to 0.05 per cent of sodium benzoate for preservation, and developed a promising grape ginger ale in which grape concentrate replaced the usual sirup. J. H. Irish and Richert found that grape juice could be powdered satisfactorily by adding to the juice or concentrate dextrose equal to the total solids content of the sirup or juice, after which the mixture is dried in vacuo, cooled, ground, and mixed with from 5 to 20 per cent of dry dextrose to prevent the formation of lumps.

Heat destruction of yeasts and molds responsible for the spoilage of bottled beverages was found not to be affected greatly by the pH of the medium. Most of the yeast cultures were killed at slightly less than 65° C., while the spores of a penicillium mold isolated from bottled cider withstood a temperature of 80° but were destroyed at 85°.

Further studies by Cruess (E. S. R., 61. p. 387) of the most favorable H-ion concentration for the treatment of ripe olives showed that the olives could be heated at 120° F. in the presence of sufficient NaOH to give a pH value of 9.4 to 10 without noticeable effect on flavor or texture, but that for pasteurization at 150° the pH value should be lower, about pH 8.6 to 8.8, to prevent softening and the development of a scorched taste. Previous findings that the pH value of ripe olives should be within a narrow range, pH 6.8 to 8, to prevent softening and bleaching, were confirmed.

The composition of tomatoes was found by H. G. Saywell to be affected by the time of picking, locality, and variety. The total solids and total acidity of tomatoes grown in the cool coastal localities were higher than those of the same variety grown in the hot interior districts of the State. In most samples the sugar content represented approximately 50, and the protein 16, per cent of the total solids.

In further experiments on freezing storage M. A. Joslyn found that nonacid vegetables could be preserved satisfactorily by this method if blanched or stored in dilute brine. Fruits stored in dilute sirup were superior in flavor and color to those stored without added liquid.

Low salt concentration and bacterial action were found by Joslyn to be factors contributing to the softening of dill pickles.

The toxicity of sodium benzoate to *Clostridium botulinum* was found by Cruess to be greatly affected by the pH of the medium. The concentration of sulfur dioxide required to prevent yeast growth was greater at values near neutrality than at low pH. A similar relationship was found to hold between the pH and salt concentration required to prevent growth of mycoderma in cucumber juice.

The frozen-pack method of preserving berries in the Pacific Northwest, H. C. DIEHL, J. R. MAGNESS, C. R. GROSS, and V. B. BONNEY (*U. S. Dept. Agr., Tech. Bul. 148* (1930), pp. 38, figs. 15).—This joint contribution from the Bureau of Plant Industry and the Food, Drug, and Insecticide Administration is of interest primarily to fruit growers, canners, and cold storage operators. Data are summarized on the quantities of fruit of different kinds, types of package, and variety of pack used in the preservation of fruits by the frozen-pack method in the Pacific Northwest in 1926 and 1927, and a brief discussion is given of the general methods followed in the preparation and handling of fruits for frozen storage. The greater part of the publication is devoted to the report of an investigation carried on in 1924, 1925, and 1926 to determine the rates of cooling of barreled berries in different containers when packed with and without sugar and when exposed to various temperatures; the effect of different sugar concentrations upon the water content and texture of the fruit; the effects of different methods of handling the containers upon the freezing of the fruit mass and upon the sugar distribution through it; and the development of yeasts and molds and of fermentation in fruit packed with or without sugar, particularly as influenced by different temperatures.

White and brown bread, R. MCCARRISON (*Brit. Med. Jour., No. 3593* (1929), pp. 913, 914).—In this contribution to the white-whole wheat bread controversy data are summarized on the percentage increases in body weight of comparable groups of rats after 54 days' feeding of basal diets of white flour and

whole wheat flour alone and with the following additions: Butter (1.25 gm. per rat daily); dried yeast (5 per cent); butter and dried yeast; tomatoes and greens ad libitum; tomatoes, greens, and butter; meat residue (10 per cent); whole milk ad libitum and in amounts of 1, 2, 5, and 10 cc. per rat daily; and whole milk ad libitum with dried yeast. In every instance except the whole milk and dried yeast combination the increases in weight were higher on the whole wheat flour diet than on the white flour.

In the second series of experiments the basal diet consisted of wheat bread containing approximately 2 per cent of yeast and whole wheat unleavened bread (chapatti) made from rapidly grown Nilgiri wheat of inferior quality. These were fed alone and supplemented by vegetable margarine (1.25 gm.); butter (1.25 gm.); tomatoes and greens ad libitum; tomatoes, greens, and vegetable margarine; tomatoes, greens, and butter; meat residue (10 per cent); whole milk (2.5 cc.); whole milk and vegetable margarine; and tomatoes, greens, and milk (2 cc.). In every case growth was superior on the whole wheat unleavened bread. This bread, "with milk, milk products, vegetables, and fruit, constitutes the diet of certain races of northern India, who, so far as physical efficiency is concerned, are amongst the finest of mankind. Their children, invariably breast-fed in infancy, know no other bread than whole wheat chapatti, which they begin to eat from the age of 2.5 years onwards. It does not appear to exercise any irritating action on their intestinal tracts."

Our daily bread (*Jour. Amer. Med. Assoc.*, 94 (1930), No. 10, pp. 718, 719).—In this editorial comment on the whole wheat-white flour controversy the following view is taken: "The advocates of the use of 'whole wheat' correctly refer to the chemical advantages of this food product. It contains more of the bran with its constituent proteins and salts, together with a slight increment of vitamins B and G. Cereals are not to be looked on as the dominant source of vitamins in any event, so that the comparison of wheat in different degrees of milling extraction seems somewhat gratuitous. The branny coats are admittedly resistant to digestion; witness the use of bran as a laxative. One may well argue, therefore, that any inherent chemical advantages in the richer content of protein in whole wheat are offset in some degree at least by its poorer utilization. The choice may therefore well be left to individual preferences and tastes."

Foods and nutrition (*New York Cornell Sta. Rpt.* 1929, pp. 77, 78).—The eggs of hens receiving cod-liver oil in addition to a ration of yellow corn meal, wheat bran, wheat middlings, meat scrap, skim milk powder, ground limestone, and sodium chloride showed a slight increase in vitamin A content over eggs laid by hens on the basal ration alone. Exposure to sunlight or ultra-violet light was without effect on the vitamin A content of the eggs.

Eggs laid by hens receiving 1.5 per cent of cod-liver oil in addition to the basal diet noted above had a much higher content of vitamin D than eggs laid by hens on the basal diet alone. Ultra-violet treatment and exposure to sunlight also increased the vitamin D content, but not to as great an extent as cod-liver oil.

In an investigation of the rate of digestion of fats as determined by chylomicrons of the blood, experiments were first conducted on college women and later on rats. In the former the results obtained indicated that the rate of digestion of butter and cream when fed with bran was practically as rapid as when fed alone. The rate of digestion of cod-liver oil was practically the same as for butter, and of goat butter and cream much slower. In the experiments with rats, bran or cellophane used as roughage slowed down the digestion of butter very decidedly, but did not interfere with the completeness of digestion.

The effect of the diet of the hen on the iron and copper content of the egg, C. A. ELVEHJEM, A. R. KEMMERER, E. B. HART, and J. G. HALPIN (*Jour. Biol. Chem.*, 85 (1929), No. 1, pp. 89-96).—Unsuccessful attempts to raise the iron and copper content of eggs by prolonged feeding of the hens with 50 mg. of iron or 50 mg. of iron plus 0.5 mg. of copper daily in addition to a good stock ration are reported from the Wisconsin Experiment Station.

The high phosphorus content of egg yolk necessitated certain modifications in technic in the use of the Thomson thiocyanate method of determining iron, based on the suggestion of Fowweather (E. S. R., 55, p. 613) concerning the use of hydrogen peroxide as an oxidizing agent and of R. P. Kennedy² in the use of amyl alcohol in extracting the colored ferric thiocyanate. In place of using the hydrogen peroxide to destroy the organic matter without ashing it was used to oxidize the ash after ignition in a furnace. The modified technic is described in detail.

The average content of iron in the dried yolk of eggs laid by the hens after 14 weeks on the regular ration was 0.0151 per cent. Corresponding figures for the eggs laid by the hens receiving the iron supplement alone was 0.0134 and the supplement of iron and copper 0.0148 per cent. The content of iron in egg white is so low that no determinations were made. The average copper content of the dried egg yolk was 0.00071 and of the white 0.00051 per cent. Corresponding values for the eggs of the iron supplemented hens were 0.00063 and 0.00053, and for the hens supplemented with iron and copper 0.00068 and 0.00046 per cent, respectively.

The production of edema and serum protein deficiency in white rats by low protein diets, R. A. FRISCH, L. B. MENDEL, and J. P. PETERS (*Jour. Biol. Chem.*, 84 (1929), No. 1, pp. 167-177, figs. 3).—An earlier investigation by Kohman (E. S. R., 42, p. 865) of the production of edema in rats by means of low protein diets has been repeated and extended, with results confirming the conclusion that edema can thus be produced. Two diets were used, both containing 360 gm. of starch, 60 of lard, and 35.6 of McCollum and Davis salt mixture, with 4,500 gm. of carrots in one case and 550 in the other. All of the rats with the exception of one group on the larger amount of carrots (wet diet) were given water ad libitum. The animals on the dry diet ate more food and consequently more protein calories than those on the wet diet, but all consumed less than their protein requirement.

Although the number of animals used was too small to permit conclusions to be drawn concerning the frequency with which edema will develop on these diets, there were some cases in both groups and apparently more on the dry than on the wet diet. Two of the animals developing edema on the dry diet recovered and were able to grow normally and reproduce following the sole addition of casein to the diet. The serum proteins showed a marked reduction in almost every case after two or three months whether or not edema was produced. It is considered that the serum proteins were only partly responsible for the production of edema, serving to determine a tendency toward water retention which is influenced by various other factors.

The influence of protein and inorganic phosphorus on serum calcium, J. P. PETERS and L. EISENBERG (*Jour. Biol. Chem.*, 84 (1929), No. 1, pp. 155-166, figs. 5).—The authors have analyzed the data obtained from 118 simultaneous observations of serum calcium, inorganic phosphorus, and protein in their own laboratory and from a previous report of H. A. Salvesen and G. C. Linder⁴ to evaluate the relative effects of protein and phosphorus on serum calcium. The

² *Jour. Biol. Chem.*, 74 (1927), No. 2, pp. 385-391, fig. 1.

⁴ *Jour. Biol. Chem.*, 58 (1923), No. 2, pp. 617-634, figs. 4.

serums were all obtained from patients in whom there was no reason to suspect the presence of any defect in calcium metabolism. In the authors' data the serum inorganic phosphorus varied from 1.5 to 29 mg. per 100 cc. and the protein from 2.8 to 8.4 per cent. In the data of Salvesen and Linder there were even lower protein values.

The data are thought to confirm previous observations that both phosphates and proteins have an influence upon serum calcium. The relation of the three components has been defined by the equation $Ca = -0.255 P + 0.566 \text{ protein} + 7$. An alignment chart has been constructed to conform to this equation, and by means of this chart it is possible to estimate the value of calcium to be expected with observed values of phosphorus and protein.

It is emphasized that the physiological or pathological significance of abnormalities in serum calcium "can not be evaluated unless inorganic phosphate and protein are determined simultaneously, and then only by the aid of some standard for which the chart here presented offers a first approximation."

The results of the ingestion of certain calcium salts and of lactose, C. S. ROBINSON, C. F. HUFFMAN, and M. F. MASON (*Jour. Biol. Chem.*, 84 (1929), No. 1, pp. 257-267).—This report from the Michigan Experiment Station deals with the results of the ingestion of calcium chloride alone, lactose alone, calcium lactate alone and with lactose, and calcium phosphate alone and with lactose on the blood picture and calcium-phosphorus balance of young male calves on a basal ration calculated to keep the animal in calcium-phosphorus equilibrium or a slight positive balance. In general the animals were kept for alternate weeks on the basal diet alone and supplemented with one after another of the materials to be tested. Calcium chloride was fed for four days only and lactose in one case for two weeks.

Under the conditions of the experiment serum calcium was raised by calcium chloride and calcium lactate plus lactose, slightly raised at first and then lowered by lactose alone, and unchanged by the other supplements. The inorganic phosphorus of the blood was raised by bone meal alone and with lactose and by lactose alone and lowered by calcium lactate alone and with lactose.

Calcium chloride caused a marked loss in phosphorus distributed between the urine and feces. Only about 10 per cent of the calcium was retained and probably not over 30 per cent absorbed at all. The administration of calcium lactate was accompanied by an increased retention of dietary phosphorus and a retention of about 50 per cent of the calcium of the lactate. About 20 per cent of the calcium and phosphorus of bone meal given alone was retained. Lactose increased the calcium retention from bone meal, but not from calcium lactate. It doubled the phosphorus retention from the bone meal and increased to about the same extent the retention of dietary phosphorus when administered with calcium lactate.

These results indicate that for therapeutic purposes calcium lactate is the compound of choice on account of its effect upon the retention of both calcium and phosphorus.

Indole derivatives in connection with a diet deficient in tryptophane, II, R. W. JACKSON (*Jour. Biol. Chem.*, 84 (1929), No. 1, pp. 1-21, figs. 8).—In continuation of the investigation noted previously (*E. S. R.*, 57, p. 487), the author has tested nine additional indole derivatives for their ability to replace tryptophane in a synthetic ration for rats.

Of all the materials tested, indole pyruvic acid alone caused resumption of growth on a tryptophane-free diet. Food consumption records showed increases when tryptophane or indole pyruvic acid was added to the diet and decreases when omitted.

In order to answer the question as to whether the increased food consumption was due to the condimental effect of the added material, as suggested by Mitchell (E. S. R., 58, p. 790), or to a stimulation of general metabolism, as suggested by Rose (E. S. R., 59, p. 687), rats were brought to an approximate weight maintenance on the tryptophane-deficient diet and then given 25 mg. daily of tryptophane in the vitamin B mixture apart from the basal diet. This led to fair growth which, in the opinion of the author, could not be attributed to any condimental effect.

A series of paired experiments was then run, keeping the food consumption (basal diet) of the one receiving the supplement equal to that of the control receiving no supplement. Those receiving the supplement grew for a short period and then remained stationary in weight until the allowance of the basal diet was increased, when growth was again resumed. This was thought to indicate that an animal eating ad libitum of a diet limited to maintenance level in one essential factor ingests just about the quantity of food that can be used advantageously with the amount available of the limiting factor. An illustration is given of a rat long stunted by deficient tryptophane which was able to resume growth at a rapid rate after tryptophane had again been administered.

Failure of a diabetic patient to utilize dried artichoke powder, L. E. WESTCOTT and E. C. WISE (*Arch. Int. Med.*, 44 (1929), No. 3, pp. 362-367).—A diabetic subject with an average dextrose tolerance of 176 gm. daily on a measured diet without insulin treatment showed no increase in tolerance in two periods in which dried artichokes equivalent to 30 gm. of levulose were added to the diet. The pH of the feces was not changed appreciably during the artichoke feeding. The authors conclude, contrary to the opinion of Carpenter and Root (E. S. R., 61, p. 195), that dried, powdered artichokes have no advantage as a diabetic food.

The accessory factor of nutrition called factor A in crude and refined olive oils [trans. title], M. JAVILLIER and L. EMERIQUE (*Bul. Soc. Sci. Hyg. Aliment.*, 17 (1929), No. 8, pp. 420-422).—Samples of crude olive oil of Greek origin and the same oil after refining by customary commercial methods were fed to young rats as the sole source of vitamin A to the extent of 15 per cent of the ration. On the crude oil the rats grew normally for about 40 days and then at a slower rate until about the one hundred and fortieth day of feeding, after which they began to lose weight. When the experiment was terminated at the one hundred and fiftieth day, only one of the six animals showed any sign of eye trouble and this only slight. The rats on the refined oil likewise grew for about 40 days, but after a slight period of stationary weight lost weight rapidly, and died at about the ninetieth day with marked symptoms of A deficiency. These results are thought to indicate that olive oil may contain appreciable amounts of vitamin A which are destroyed during the refining process.

The relation of vitamin A content to size of leaves, L. McLAUGHLIN (*Jour. Biol. Chem.*, 84 (1929), No. 1, pp. 249-256, figs. 3).—Determinations by the Sherman-Munsell method of the vitamin A content of equal weights of New Zealand spinach leaves of three different sizes showed the potency of the leaves to vary inversely with the size. The ratios of thickness of the leaves were approximately the reverse of leaf potencies, indicating that the vitamin A content of green leaves depends upon their surface area. With small leaves somewhat less than 90 mg. and more than 70 mg. per week, with medium leaves about 90 mg., and with large leaves more than 110 and less than 120 mg. were required for the standard gains of 25 gm. in 8 weeks. New Zealand spinach is thus a very rich source of vitamin A.

On the contents of vitamins B in ripening and germinating wheat grains [trans. title], Z. WIERZCHOWSKI (*Pam. Państw. Inst. Nauk. Gosp. Wiejsk. Puławach* (*Mém. Inst. Natl. Polon. Écon. Rurale Puławay*), 9 (1928), No. 2, pp. 537-554, figs. 7; *Eng. abs.*, pp. 552-554).—Pigeons weighing about 300 gm. each were fed a basal diet of wheat dried at 120° C. until they had lost from 10 to 20 per cent in weight and were then fed the material to be tested as supplements. The prevention of loss in weight and cure of avitaminosis were both considered in estimating the supplementing values of the materials examined. These included young unripe wheat grains collected 15 to 18 days after the fading of the blossoms, grains germinated until sprouts from 1.5 to 2 times longer than the grain had formed, and mature grains. Some of the unripe and sprouted grains were also dried rapidly before feeding.

Two gm. of the normal, mature wheat was considered the effective dose. With germinated wheat, an amount obtained by germinating only 0.5 gm. of the wheat proved as effective as 2 gm. of the normal, mature grains. Of the young green grain, 1.1 gm. (containing as much dry matter as 0.5 gm. of the normal grain) was as effective as 2 gm. of the normal, mature grain. Drying of the young green grains at 20° caused a decrease in the quantity of vitamin B in the grains.

The germinated grains are considered to be a particularly good source of vitamin B as they are easy to obtain in a fresh state at every season of the year.

Nutritive equilibrium and artificial milks [trans. title], L. RANDOIN and R. LECOQ (*Compt. Rend. Soc. Biol. [Paris]*, 102 (1929), No. 28, pp. 371-373).—Samples of dried artificial milk with composition similar to human milk and goat's milk were tested on pigeons. With no vitamin B supplement polyneuritis developed. When 1 gm. daily of yeast was fed as a source of vitamin B the pigeons did not survive more than three or four months, but when smaller amounts were fed the survival periods were longer, particularly in the case of the milk containing the lowest amount of lactose. The authors conclude that when the carbohydrate of the ration is lactose nutritive equilibrium is possible only in the presence of optimal proportions of vitamin B.

Studies on the effects of overdosage of vitamin D, R. F. LIGHT, G. MILLER, and C. N. FREY (*Jour. Biol. Chem.*, 84 (1929), No. 1, pp. 487-494, fig. 1).—An investigation of the calcium, phosphorus, and ash balances, blood serum calcium and phosphorus, ash and calcium-phosphorus ratio of bones, hearts, and kidneys, and weight curves of groups of young rats fed varying amounts of vitamin D is reported. The conclusion is drawn that dosages as high as 10,000 times the daily curative dose over a period of six months have no harmful effect, but that dosages as high as 100,000 times the daily curative dose cause a drainage of mineral constituents from the body, with a relatively greater elimination of phosphorus than of calcium.

The relations of weight, height, and age in negro children, L. T. ROYSTER and C. N. HULVEY (*Amer. Jour. Diseases Children*, 38 (1929), No. 6, pp. 1222-1230, figs. 7).—This report is based upon weight-height measurements of 8,876 negro children, comprising 4,595 girls and 4,281 boys, in various public schools in Virginia. The weights and measurements were those recorded in the course of the routine school clinics and inspections. The children were weighed without outer wraps and the heights measured without shoes.

The data were first arranged to show the relation of weight to height for age and compared with the corresponding tables of Baldwin and Wood. The table for boys showed practically identical weights with respect to height and age for negro and white boys measuring from 45 to 60 in., inclusive. The weights

of the negro boys were from 1 to 3 lbs. lighter at from 61 to 67 in. (except that at 65 in. and 16 years the negro boys were 5 lbs. lighter) than the corresponding white boys. The figures for negro and white girls were approximately identical throughout.

Without regard to age, the average weights according to height were the same for negro and white children up to 52 in., after which the negro children weighed less than the white, the variations becoming greater until at 65 in. there was a difference of 5 lbs. for the boys and 6 for the girls. A comparison of the height-weight curves for negro boys and girls showed that at heights of from 45 to 49 in. the girls weighed slightly less than the boys of the same height (except at 47 in. when the weights were the same). At heights of 49 to 52 in. the weights of the boys and girls were identical, and at heights of from 52 to 65 in. (with the exception of 54 in. at which the weights were identical) the girls were heavier than the boys.

In the relation of height to age, the present figures showed for the boys no variation from the Baldwin-Wood tables at 5 years, but from the sixth to the sixteenth year, inclusive, a constant minus variation for the negro boys. At the sixth and seventh years the figures for the girls showed a slight positive variation, between the seventh and eighth years the lines crossed, and from then on the variations were minus. The maximum growth was reached at 15.5 years for the negro girls and at 16 years for the white girls.

A comparison of the age-height ratios for negro boys and girls showed three points at which the lines crossed, at 6.5, 10, and 13.5 years. During the first and third periods the girls were taller and the second and fourth periods shorter than the boys.

TEXTILES AND CLOTHING

The effect of tin weighting on the nitrogen content and physical properties of silk, W. M. FORBES and P. B. MACK (*Jour. Home Econ.*, 21 (1929), No. 11, pp. 841-849).—Following a general description of the main steps in the weighting process for silk fabrics and of the chemical nature of silk, a report is given of a study of the effect of different degrees of weighting upon the total and amino nitrogen and upon various physical properties of samples of satin-faced crêpe. The technic of determining the amount of weighting and the various physical tests used are outlined. The analyses were all made upon the silks shortly after weighting and consequently do not show any possible effect of aging subsequent to the weighting.

Both total and amino nitrogen decreased with increased weighting, thus pointing to a partial breakdown of the protein of the silk, accompanied by a loss of nitrogen.

The results obtained in the physical tests showed that in general the warp threads, which were soft and loosely woven, increased in breaking strength with the weighting. The filling threads, which were tightly twisted, decreased rapidly with increased weighting, the sum of the two effects being a decrease in breaking strength with each successive increase in weighting. Samples which had been silicated as well as tin weighted gave a lower breaking strength than samples of the same degree of tin weighting with no silicate. The breaking strength per unit weight of fabric showed consistently a marked decrease with each increase of tin weighting. This is considered significant, inasmuch as the value of a piece of silk is often judged by the appearance of weight. The tearing strength decreased with weighting, and the bursting strength of weighted samples was always less than of unweighted, but not always in

proportion to the amount of weighting. Resistance to abrasion was markedly decreased in the weighted samples.

Effect of dry cleaning on unweighted and weighted silk, E. L. CLAIR and P. B. MACK (*Jour. Home Econ.*, 21 (1929), No. 11, pp. 850-854).—In this report of a study of the effect of the various processes followed in the dry cleaning of fabric upon samples of unweighted and weighted silk corresponding to those used in the previous study, considerable information is given on the standard procedure for dry cleaning and on materials used in "spotting" to remove different kinds of stains.

The dry cleaning process proper had no effect upon the nitrogen content, little effect upon the breaking strength, and a beneficial effect upon the bursting strength, tear resistance, and resistance to abrasion.

All of the stains used, which included black carbon and blue fountain-pen ink, blood, perspiration, mercurchrome, tincture of iodine, rust, mineral oil, and tannin, if allowed to remain on the silk for as long as three weeks caused decomposition of the silk, particularly of the weighted silk. Of the spotting agents used, those of an acid character caused disintegration of the weighted silks by the removal of tin. Dyes applied in an acid bath caused similar deterioration.

Different methods of pressing were tested, including an electric iron at 100° C., steam at 100°, and a steam pressing machine at 95 to 100°, each for 25 minutes over an area of 1 sq. ft. As judged by breaking strength, moist heat produced less tendering than dry heat on the silks, whether weighted or unweighted. Except in the case of the two most heavily weighted pieces, the steam pressing machine had less tendering effect than the steam iron.

Effect of home laundry methods upon the breaking strength of unweighted and weighted silks, B. COHEN and P. B. MACK (*Jour. Home Econ.*, 21 (1929), No. 11, pp. 854, 855).—A brief summary is given of the effect of various home laundry methods on weighted and unweighted silks such as used in the two previous studies.

Soaking in distilled water at room temperature for 7, 12, and 24 hours, respectively, had little effect upon the breaking strength of the silk, either weighted or unweighted. A temperature of 50° C. had less tendering effect than higher temperatures upon all of the samples and was sufficiently high to remove ordinary types of soil. The soaps used included a white and a rosin soap containing free alkali, a white neutral bar soap, and a white neutral flake soap. The silks were washed for 2 hours in distilled water at 50° with 10 gm. of soap per liter. Neither of the neutral soaps reduced the breaking strength greatly, but both of those containing free alkali had a serious effect upon all samples, particularly the most heavily weighted one. Water containing calcium or magnesium sulfate lowered the breaking strength of the fabrics more than did water containing calcium bicarbonate on account of the slight acid reaction of the first two salts.

Of the mechanical processes tested, rubbing between the knuckles had the greatest tendering effect on all of the samples except the most heavily weighted piece, followed in decreasing order by washing between cupped hands and washing on a board. Washing with a disc-type washing machine produced the least tendering except in the case of the most heavily weighted piece, on which it had the greatest tendering effect.

The effect of certain laundry soaps on selected dress ginghams, B. M. VIEMONT and L. BAKER (*Jour. Home Econ.*, 21 (1929), No. 4, pp. 273-282).—This study, while admittedly not extensive enough to justify positive statements regarding the optimum temperature of the water and the concentration of soap to use when laundering colored fabrics, has resulted in the establishment of a

definite method of procedure which is thought to be satisfactory for further studies of the best soap solutions to use on colored fabrics.

The fabrics used consisted of two kinds of gingham suitable for house dresses and children's play clothes in pink, blue, and tan colors of similar intensity. The soaps were representative of three types of white cake soaps—a pure soap, a naphtha soap, and a filled soap. Analyses were made of the fabrics and soaps but are not reported. The materials were put through a similar washing process in distilled water, 0.12 and 0.5 per cent soap solution at 30 and 70° C., and then tested for tensile strength, shrinkage, and fading.

Distilled water appeared to increase the tensile strength of the fabric over that of the original in both warp-wise and filling-wise strips. The two materials did not react the same with the different soaps. In one material the naphtha soap caused less deterioration in tensile strength than the other two in more than half the tests, and this was true of the pure soap in the other. In a few instances tensile strength was greater after than before treatment. Fading was tested only by comparing the color of the wash waters with that of a similar soap solution in which no fabric had been washed. In no case was the color altered appreciably.

Selected list of Government publications on textiles and clothing, compiled by R. VAN DEMAN (*U. S. Dept. Agr., Bur. Home Econ., Home Econ. Bibliog.* 3, rev. (1930), pp. 17).—A revision, also in mimeographed form, of the bibliography noted previously (*E. S. R.*, 53, p. 94).

MISCELLANEOUS

List of bulletins of the agricultural experiment stations for the calendar years 1927 and 1928, C. E. PENNINGTON (*U. S. Dept. Agr., Misc. Pub.* 66 (1930), pp. 78).—This supplements the list previously noted (*E. S. R.*, 58, p. 395).

Fifty years' index, 1877–1927, E. H. JENKINS (*Connecticut State Sta. Bul.* 309 (1929), pp. 107–182).—This is first of all a general index to the annual reports and certain early bulletins of the station so far as these relate to “matters of permanent interest and value.” It supplements previous indexes (*E. S. R.*, 34, p. 458; 55, p. 898; 57, p. 89) and an index of hosts and fungi in preparation by the botany department. Bulletins of Immediate Information are listed, but their subject matter is not indexed.

Following the general index are (1) an index to analyses of miscellaneous materials, (2) a list of the personnel, (3) a list of all bulletins issued since the founding of the station, and (4) lists of all publications, including journal papers, arranged according to departments.

Information regarding recent publications (*Kansas Sta. Circ.* 149 (1929), pp. 3).—This circular briefly describes Bulletins 246–248 and Circulars 142–148, previously noted.

Report of the [California] Agricultural Experiment Station, [1929], E. D. MERRILL (*California Sta. Rpt.* 1929, pp. [1] + 123, pl. 1).—This contains the organization list, a report of the director and summary of the work of the station for the year ended June 30, 1929, including data as to projects and publications, and a summary, by B. H. Crocheron, of the work of the agricultural extension service (pp. 115–123). The experimental work reported not previously noted is for the most part abstracted elsewhere in this issue.

Annual report of the director for the fiscal year ending June 30, 1929, C. A. McCUE ET AL. (*Delaware Sta. Bul.* 162 (1929), pp. 74, figs. 7).—This contains the organization list, a report of the director including a financial state-

ment for the fiscal year ended June 30, 1929, and departmental reports. The experimental work recorded not previously noted is for the most part abstracted elsewhere in this issue.

Ninth Annual Report [of Georgia Coastal Plain Station], 1928, S. H. STARR (*Georgia Coastal Plain Sta. Bul. 11* (1929), pp. 74, fig. 1).—This contains the organization list and a report of the director on the work of the station. The experimental work reported is for the most part abstracted elsewhere in this issue.

Forty-second Annual Report [of New York Cornell Station], 1929, A. R. MANN (*New York Cornell Sta. Rpt. 1929*, pp. 89).—This contains a summary of some of the more important research projects completed or markedly advanced during the year 1928-29, together with references to the publications of the year. The experimental work reported not previously noted is abstracted elsewhere in this issue.

Report of the Porto Rico Agricultural Experiment Station, 1928, D. W. MAY ET AL. (*Porto Rico Sta. Rpt. 1928*, pp. [2]+38, figs. 9).—This contains the organization list, a report of the director as to the general conditions and lines of work conducted at the station during the year, and reports of the assistant chemist, horticulturist, plant breeder, agriculturist, plant pathologist, and parasitologist. The experimental work is for the most part abstracted elsewhere in this issue.

The application of science to crop-production, A. and G. L. C. HOWARD (*London and Bombay: Humphrey Milford, Oxford Univ. Press, 1929*, pp. [5]+81, pls. 12, figs. 7).—This book is noted editorially on page 701 of this issue.

NOTES

Connecticut State Station.—A field station that provides for a new project, the study of soil fertility in relation to vegetable growth, and the expansion of vegetable breeding investigations has been established near the Tobacco Substation in Windsor. Work on the new field, which will be concerned primarily with early crops, supplements the studies of the older Mount Carmel farm which has a heavier soil type. Part of the land is to be used to grow nursery stock for forest planting under the Clarke-McNary Act.

The last general assembly passed a pure seed law modeled very closely after the so-called uniform seed law. Under this statute the State commissioner of agriculture is charged with the collection of samples and general administration, while the station has accepted responsibility for the examination of samples.

The State Board of Finance and Control has made an addition of \$6,000 to the station appropriation for the control of insect pests. This money will be used for the European corn borer clean-up and Japanese beetle control for the rest of the fiscal year.

Missouri University and Station.—Dean Walter Williams of the School of Journalism has been appointed president of the university. Former President S. D. Brooks has been given leave of absence until December 31, 1930. Drs. W. A. Albrecht and Samuel Brody, associate professors, respectively, of soils and dairy chemistry, have each been given a year's leave of absence to be spent in Europe.

New Jersey Stations.—Kenneth R. Stevens has resigned as research assistant in soil microbiology and has been succeeded by Melville A. Clark. Juan A. Bonnet has been appointed assistant in soil microbiology.

Cornell University and New York Stations.—The additions to facilities, resources, and responsibilities of the New York State Colleges of Agriculture, Home Economics, and Veterinary Medicine at the university and the State Station at Geneva recently made available are announced as the greatest in the history of the institutions. These accessions have resulted from the cooperation of the governor and the legislature, the governor's agricultural advisory commission, the agricultural conference board, and groups of farmers who desired the assistance of the colleges and stations.

Of major importance among the items for work at Ithaca are an act authorizing a new building for agricultural economics and related lines at a cost of \$650,000, of which \$100,000 is immediately available to begin construction, and a grant of \$510,000 to be added to the \$485,000 appropriated last year for a new home economics building. The present home economics building will be occupied by the department of entomology.

The regular budget of the College of Agriculture was increased by \$82,020 plus the permanent incorporation of \$51,050 provided in a special bill last year for the animal husbandry department. Other items for the college include \$160,000 for the construction of barns and facilities for animal husbandry and the purchase of additional land, \$14,000 for an office and labora-

tory building and a tool shed at the Long Island vegetable research farm, \$415,000 for equipment of the plant science building and grounds, \$20,000 for the survey of agricultural resources of the State, \$16,500 for investigations of the spraying and dusting of potatoes on Long Island, \$5,500 for extension work in potato growing, \$5,800 for investigations in the grading and handling of vegetable crops, \$6,010 for investigations in control of insects affecting muck soil crops, \$4,000 for investigations in control of insects affecting potatoes, \$5,900 for an experiment to determine the optimum percentage of protein in a dairy ration, \$60,000 for equipment and maintenance of the western and central New York egg-laying contests, and \$40,500 for additional State support of county farm and home bureaus and junior extension work.

Another legislative enactment of outstanding importance is an act signed by the governor on March 21 admitting all of the staff and other employees of the State colleges and stations to the privileges of the State retirement system. This makes substantial provision for retirement allowances and solves one of the chief problems confronting these institutions.

The allotments to the State Station include in addition to those previously reported \$37,000 for investigations looking toward the control of the oriental peach moth, apple maggot, and other insects. M. G. Moore, assistant in research (chemistry) at this station has resigned to accept a commercial position.

North Carolina Station.—A critical survey of the experimental work being carried on by the station was made on March 4 and 5 by a special committee composed of seven farmers and business men who are members of the college board of trustees and represented all parts of the State. During the course of the survey, the committee visited each department of the station and in addition to hearing of the work was furnished a brief report giving a summary of important results and some idea as to the nature of the projects underway. The committee also discussed with each project leader the nature of his work, the equipment on hand, the facilities available, the needs, and other important items. A full report will be made to the board of trustees at its annual meeting in June.

Following its policy of carrying the research work of the station to the people of the State, a series of special meetings will be held at each of the six branch stations throughout the crop year. Two such meetings have been held at the Upper Coastal Plain Branch Station near Rocky Mount, when cotton and peanut growing was taken up, and another at the Blackland Branch Station near Wenona, when beef cattle tests for eastern Carolina growers were explained.

Rhode Island College.—Dr. Howard Edwards, president since 1906, died April 10 in his seventy-sixth year. President Edwards was a native of Virginia, received the M. A. degree from Randolph-Macon College in 1876, studied at the University of Leipzig, 1877-78, and the Sorbonne of Paris, 1891-92, and had been given the honorary LL. D. degrees by the University of Arkansas in 1891, Brown University in 1914, and the Michigan State College in 1927 and the Litt. D. degree by the Rhode Island Normal College in 1927. Practically his entire life was spent as a teacher and administrator, first in several Southern secondary institutions and later as professor of English and modern languages in the University of Arkansas from 1885 to 1890 and the Michigan College from 1890 to 1906. He had long been active in the Association of Land-Grant Colleges and Universities and its president in 1923. He was widely esteemed as a thorough scholar, an inspiring teacher and speaker, and a capable executive, and the college grew and prospered steadily under his able guidance for nearly a quarter century.

Utah College and Station.—Dr. Herbert John Pack, professor of entomology and entomologist, died January 5 at the age of 37 years. Dr. Pack was a native of Utah, a graduate of the college in 1913, and subsequently continuously engaged in its entomological service except for a period from 1914 to 1918 spent as instructor in biology in the Latter Day Saints University and one from 1924 to 1925 as instructor in entomology in Cornell University. From the latter institution he received the Ph. D. degree in 1925.

Virginia Station.—The substation at Martinsville in Henry County has been discontinued, and a new substation established at Glade Spring in Washington County for experiments on pasture improvement and the growing of feed crops for livestock. W. R. Perkins has been appointed superintendent of the new substation, effective April 1.

A field laboratory costing \$3,900 is being constructed at Charlottesville, where studies will be made on the insect pests and diseases of the apple and peach. N. A. Eaton, junior plant inspector of the U. S. D. A. Plant Quarantine and Control Administration, has been appointed assistant entomologist, effective March 27, and stationed at this laboratory.

G. M. Shear has been appointed assistant plant physiologist vice E. F. Davis, resigned.

Canadian Phytopathological Society.—This society is an outgrowth of the former Canadian Division of the American Phytopathological Society, formed in 1919 and which has now been dissolved. The first meeting of the new society was held at Ottawa December 19 and 20, 1929, at which time about 20 papers were given and the following officers were elected: President H. T. Gussow, Dominion botanist; vice president W. P. Fraser, professor of botany in the University of Saskatchewan; secretary-treasurer T. G. Major of the tobacco division, Department of Agriculture, Ottawa; and councillors D. L. Bailey, professor of plant pathology in the University of Toronto, and J. G. Coulson, professor of plant pathology, McGill University. The society will be affiliated with the Canadian Society of Technical Agriculturalists, and aside from its proceedings will publish papers in *Scientific Agriculture* until establishing its own journal.

New Journals.—*Udobrenie i Urozhai (Fertilizers and Crop Yields)*, a monthly scientific technical journal of the committee on chemical industries of the Union of Socialistic Soviet Republics and of the Scientific Institute for Fertilizers, is being published by the State Technical Publishers, Zentral Ilinka, Yushkov per., 4, Moscow. The first number has the following table of contents: A United Front to Increase Yields, by P. I. Dubov (pp. 5-8); Comparative Effects of Stable Manure and Mineral Fertilizers, by D. N. Priánishnikov (pp. 8-15); The Effect of Liming in Soil of the Podzol Zone, by A. P. Levitskii (pp. 16-21); The Phosphate Resources of U. S. S. R., by A. V. Kazakov (pp. 21-24); Khibinsk Phosphate Deposits as Source of Raw Materials for the Superphosphate Industry, by V. I. Vlodavets (pp. 24-26); The Southern Limit of the Influence of Raw Phosphate According to Recent Data, by A. N. Lebedántsev (pp. 26-30); The Manufacture of Ammonium Phosphate (Ammophos), by S. I. Vol'fkovich (pp. 30-37); A Comparison of Methods in the Extraction of Phosphoric Acid from Phosphates and Thomas Slag, by B. A. Skopintsev (pp. 37-39); Testing Field Outfits for Determining Lime Requirement of the Soil, by N. Remezov (pp. 40, 41); and New Methods of Combating Ground Borers, by I. I. Traut (pp. 41-44). The journal also has a section with abstracts under the following headings: Geology and mining, technology and analyses of fertilizers, agronomic studies and vegetation experiments, field experiments and fertilizer applications, economics and statistics, and plant protection.

Die Tierernährung, a journal devoted to teaching and research in feeds and feeding, is being issued from time to time under the editorship of Dr. A. Scheunert, Leipzig C I, Tiroler Str. 6. It will contain both original articles and abstracts within its field. The initial number contains the following articles: Source, Composition, and Digestibility of Safflower Cake and Its Nutritive Value for Milch Cows, by F. Honcamp et al. (pp. 3-29); The Source of Hippuric Acid in the Urine of Herbivora, by P. Brigl and A. Pfähler (pp. 30-36); Iodine Assimilation by Animals on Feeding of Organic Iodine, by K. Scharrer and J. Schwaibold (pp. 37-43); The Concept of Nutritive Value and Its Quantitative Estimation, by H. Möllgaard (pp. 44-64); Diagram for "Estimation of Silage Acids by Wiegner's Method," by K. Gneist (pp. 65-69); The Feeding of Milch Animals with an Oat Straw Maintenance, Vitamin A-Poor Ration and its Supplementing, by A. Scheunert and K. Bertram (pp. 70-87); Studies on Phosphoric Acid Assimilation, I, by R. Bleyer and F. Fischler (pp. 88-103); The Gain and Loss of Crude and Digestible Nutrients with Two and Three Cuttings of Clover and Meadow Grass in Experiments at the Königsberg Animal Research Institute, by W. Kirsch (pp. 104-118); and A Contribution to the Iodine Question, by J. Hansen (pp. 119-124).

Journal of the Imperial Agricultural Experiment Station, located at Nishigahara, Tokyo, Japan, is being published in the Japanese language, but with English abstracts. The initial number contains the following original articles: On the Variation of Rice Varieties in the Resistance to the Toxic Action of Potassium Chlorate, and Its Practical Significance, by M. Yamasaki (pp. 1-24); On the Premature Heading in Paddy Rice, by H. Terao and T. Katayama (pp. 25-40); On the Snow-Rot (Yukigusare) Fungus, *Typhula graminum*, Karsten, of Gramineous Plants, by H. Tasugi (pp. 41-56); On the Composition of the Lime for Fertilizer, by Y. Hayashi (pp. 57-72); and On the Potassium Thiocyanate Method for Determining the Soil Acidity, by Y. Kamosita (pp. 85-88).

Tierzucht und Tierhaltung, constituting Section B of *Wissenschaftliches Archiv für Landwirtschaft* (E. S. R., 61, p. 300), is being edited by W. Zorn. The initial number contains the following original articles: Histological Investigations on the Elemental Constituents of Rabbit Skins, with Special Consideration of the Economic Problems of the German Rabbit Industry, by H. Kleefeld (pp. 1-51); Spectroanalytical Investigations of Hair Colors, by L. Krüger (pp. 52-122); The Cuticula Pili as a Race Characteristic, by A. Elkes (pp. 123-165); and The Net Crude and Digestible Nutrients in Two and Three Mowings of Grasses Differently Manured, by H. Jantzon and W. Kirsch (pp. 166-178).

Boletín del Departamento de Agricultura is being published quarterly by the Director General of the Department of Agriculture, Santiago, Chile. In addition to official announcements, statistics, and other data, the initial number contains several original articles of varied interest, among them one on the Growing of Cantaloupes in California, by J. T. Rosa and E. L. Garthwaite (pp. 48-54).

Revista de Industria Animal is being issued from time to time by the Bureau of Animal Industry, Department of Agriculture, Industry, and Commerce, Sao Paulo, Brazil. The initial number contains a description of the bureau and its facilities and work, an account of animal husbandry in Sao Paulo, and other articles and notes.

Home Economics News is being published by The Manual Arts Press at Peoria, Ill. The initial number contains a variety of brief articles of pedagogic or popular interest, together with news notes, abstracts, and other material.

EXPERIMENT STATION RECORD

VOL. 62

JUNE ABSTRACT NUMBER

No. 9

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Colloid chemistry: Principles and applications, J. ALEXANDER (*New York: D. Van Nostrand Co., 1929, 3. ed., pp. X+270, figs. [12]*).—A second revised and enlarged edition has been noted (*E. S. R.*, 52, p. 609). The extent of the further increase in the scope of the book in its present edition is in part indicated in the contents of the six chapters of the first, or theoretical part, which are as follows: Introduction—colloid chemistry defined and suspension v. solution; material units and the forces dominating them—divisibility of the so-called elements, chemical v. physical forces, the submicroscopic structure of matter, H-ion concentration, homogeneity and heterogeneity, phases, interfacial anomalies, residual affinities, a simple principle underlying the colloidal state, the zone of maximum colloidal stability, the relation of colloidal to other forces, solution v. colloidal solution, the nature of adhesion, surface forces in grinding or pulverizing, and the "colloid mill"; classification of colloids; consequences of subdivision; the ultramicroscope; and general properties of colloids—colloidal protection, gold number, double or plural protection, autoprotection, cumulative protection, dialysis, ultrafiltration, diffusion, electric charge and migration, peptization and peptization, viscosity, and surface tension.

Considerable additions have been made also in chapters 7 to 14, which deal with the general subject of practical applications; and an appendix, *Experimental Suggestions or Laboratory Manual*, has been included.

Emulsions in theory and practice, J. E. RUTZLER, JR. (*Oil and Fat Indus.*, 7 (1930), No. 2, pp. 61-63).—This is a review and semipopular discussion. It is accompanied by a short bibliography (33 items).

The peptization of wheat flour proteins by inorganic salt solutions, R. A. GORTNER, W. F. HOFFMAN, and W. B. SINCLAIR (*Cereal Chem.*, 6 (1929), No. 1, pp. 1-17, fig. 1).—The 12 wheat flours examined at the University of Minnesota, as here reported, varied widely in the quantity of protein yielded to various salt solutions of "equivalent ionic concentration"; and an equally marked variability in the protein extractable from the series of flours by any single salt solution was observed. The last-named variation reached 100 per cent.

These differences were found independent of the H-ion concentration. They appeared to be determined (1) by the ease of peptization of the proteins in each individual flour and (2) by the specific properties of the ions of the salt of which the solution was used as extractant.

"The salt-soluble protein fraction does not represent a mixture of albumin and globulin, nor does it represent the nongluten proteins. Some salts extract

only a part of the nongluten proteins, whereas others extract very appreciable amounts of the gluten proteins. Thus 1.0 N KF extracts an average of 69 per cent of the nongluten proteins, whereas an equivalent concentration of KI extracts 340 per cent. The peptization of the wheat flour proteins by inorganic salt solutions reveals the same sort of differences as does peptization with acid or alkaline solutions. It is believed that these differences are associated with the colloidal properties of the wheat flour proteins."

Isolation and purification of the alcohol-soluble protein (prolamin) occurring in English ryegrass (*Lolium perenne*), S. L. JODIDI (*Jour. Agr. Research* [U. S.], 40 (1930), No. 4, pp. 361-370).—"The alcohol-soluble protein occurring in English ryegrass was isolated for the first time, and its purification, analysis, and properties are described. It has been named lolin, the derivation of this name being analogous to that of the names of other well-known prolamins, such as hordein and zein. During repeated alcoholic treatments at elevated temperatures, incidental to the purification, a considerable portion of the prolamin becomes insoluble. The soluble and insoluble portions of the prolamin do not appear, however, to differ from each other chemically, since they have practically the same ultimate composition as well as the same nitrogen distribution in their respective molecules."

The preparation procedure, of much the usual type, is detailed, and the elementary analysis of the preparations is given. Hausmann method figures only are given for the nitrogen distribution of the new protein. The Hausmann method, as modified by Jodidi and Moulton (*E. S. R.*, 41, p. 712), was used.

Investigations on silage, I, II, [trans. title] (*Meld. Norges Landbr. Høiskole*, 9 (1929), No. 10-11, pp. 573-623, 629-649, fig. 1; *Eng. abs.*, pp. 625-628, 646, 647).—This paper is in two parts.

I. *The chemical composition of silage and its milk producing value*, H. ISAACHSEN and O. ULVESLI.—This part is concerned with an investigation into the chemistry, digestibility, and milk production value of silage made from turnip tops, from sunflowers, and from a mixture of sunflowers, oats, tares, and peas.

Analysis was made of 14 samples of turnip top silage, of 15 samples of a mixed silage from material consisting of 75 per cent of sunflowers and 25 per cent of mixed oats, tares, and peas, and of four samples of sunflower silage. Both moist and dry samples were examined. From the moist samples was determined the protein content and the composition of the protein and the organic acids. The dried samples were examined for the constituents noted in the usual feeding stuff analyses and for protein digestibility by a pepsin hydrochloric acid solution.

It was found, in part, that the turnip top silage had the largest protein content, the sunflower product the lowest. The nitrogenous constituents computed as crude protein had a variable composition, the ammonia content ranging from 10 to 20 per cent, while from 35 to 45 per cent of amino acids and peptones were found. The proportion of ammonia was considered an index of the degree of decomposition of the protein content of the feed.

The organic acids, especially butyric acid, were found in widely varying quantities. The greater part of the volatile organic acids disappeared in the drying of the samples.

The analyses as a whole were taken as indicating, among other points, the need for special care in the treatment of sunflower and sunflower mixture materials. Best results were obtained when the fodder was taken in fair weather and held in silos closed and put under pressure immediately after filling than when the material was gathered in wet weather or not covered in the silo. The quality of the turnip top product did not show any such

marked effect of details of the process, but fair weather cutting was none the less considered the better practice.

II. *A survey of the biochemical course of the process of ensilage*, S. Hjorth-Hansen.—The process of ensilage is considered to take place in two main stages, the first, or aerobic stage, which occurs while the plant mass contains air, being characterized by very active respiration and no formation of acids. The second, or anaerobic, stage is considered to take place in two periods, in the first of which organic acids, lactic acid especially, were found to be produced in quantities sufficient to give an H-ion concentration equivalent to pH 3.7 to 4, the respiration in this first period of the second stage being described as "intramolecular." Atmospheric oxygen having been entirely used up, oxygen must be obtained from the carbohydrates, which are thereby converted into alcohol, carbon dioxide acids of the formic acid series, and lactic acid. The second period of the anaerobic stage is considered to begin when the acidity has reached that above stated. The enzymes are regarded as unable to work in so acid a medium, so that chemical and microbiological processes accordingly cease.

In two Norwegian silages examined there were found formic, acetic, propionic, *n*-butyric, and isovaleric acids, together with lactic acid.

The antiscorbutic fraction of lemon juice, VIII, S. S. ZILVA (*Biochem. Jour.*, 23 (1929), No. 6, pp. 1199–1205, figs. 2).—In order to test still further the assumption that the loss in stability of vitamin C brought about by autoclaving in a neutral medium is due to the destruction of a thermolabile factor (E. S. R., 60, p. 595), the effect of heating at temperatures lower than 100° C. was first determined. Decitrated lemon juice adjusted to pH 7 was heated in air-exhausted, nitrogen-filled ampoules at temperatures of 55 to 58 and 80 to 85°, respectively, for 1 hour, adjusted if necessary to pH 7, and kept in the cold for 7 days before being tested for vitamin C.

With the exception of one series in which the juice was heated to 55°, there was no more deterioration of vitamin C in the heated than in unheated juices in corresponding periods of storage. The destruction of the reducing principle was likewise of the same order as that of unheated solutions.

The stability of the vitamin after autoclaving was not increased by the addition of decitrated lemon juice previously inactivated by aerating at ordinary temperatures, or of the inactive precipitate obtained by treating ordinary decitrated lemon juice with alcohol, or of the neutral lead acetate fraction, although it was noted that occasionally considerable antiscorbutic activity could be demonstrated in the neutral lead acetate precipitate. Decitrated lemon, cabbage, tomato, and rutabaga juices were all found to contain a peroxidase, the activity of which persisted after the vitamin had been partially or entirely destroyed. Autoclaving decitrated lemon juice under anaerobic conditions diminished somewhat its capacity for reducing phenolindophenol, but increased its capacity for decolorizing iodine. This increased capacity for decolorizing iodine was not observed after decitrated lemon juice had been heated anaerobically at 58 or 85°.

These observations suggested the possibility that the decrease in stability of vitamin C produced by autoclaving is due to the formation of a substance which hastens the destruction of the vitamin rather than to the destruction of a thermolabile stabilizing factor. This suggestion received confirmation in the decreased antiscorbutic properties and capacity to reduce phenolindophenol of autoclaved decitrated lemon juice when mixed with unheated juice and stored for 7 days. The addition of quinol to decitrated lemon juice had the same effect.

A study of the preparation and properties of vitamin C fractions from lemon juice, H. L. SIPPLE and C. G. KING (*Jour. Amer. Chem. Soc.*, 52 (1930), No. 1, pp. 420-423).—In the first attempt at concentrating vitamin C in lemon juice, the lemon juice was decitrated with an excess of neutral lead acetate solution, the remaining lead removed from the filtrate by precipitation with 10 per cent phosphoric acid solution, the filtrate from this precipitate concentrated in vacuo below 50° C. and then treated with two volumes of alcohol and filtered, the alcohol removed from the filtrate by vacuum evaporation, and the residual concentrate diluted with distilled water to half of the equivalent volume of lemon juice. The concentrate thus prepared, when tested on guinea pigs by the method of Sherman, LaMer, and Campbell (*E. S. R.*, 46, p. 865), showed no loss in antiscorbutic property.

Decitrated lemon juice from which the excess of lead acetate had not been removed was adjusted with dilute ammonium hydroxide to pH 7.4 to 7.6. The yellow precipitate which formed was centrifuged quickly, dissolved in dilute acetic acid, reprecipitated with dilute ammonium hydroxide as before, and again centrifuged and redissolved in acetic acid. The lead was removed from all fractions by precipitation with 10 per cent phosphoric acid solution. Both the first and second precipitates retained most of the original activity, but the second contained a smaller amount of total solids than the first, thus indicating greater purification.

An aqueous solution of the second precipitate was treated with two successive portions of *n*-butyl alcohol as in the method of Grettie and King (*E. S. R.*, 62, p. 501). After removing the butyl alcohol, the aqueous extract was concentrated, dissolved in 98 per cent alcohol, and treated with one volume of peroxide-free absolute ethyl ether, and the white crystalline inactive precipitate was filtered off. The active liquid was found to contain 0.56 mg. of total solids per cubic centimeter of the equivalent lemon juice, with an inappreciable amount of ash. Reducing substances as glucose amounted to 0.45 mg. per cubic centimeter, ammonium salts expressed as nitrogen 0.045 mg., and total nitrogen as determined by the micro-Kjeldahl method 0.145 mg. of nitrogen per cubic centimeter. The ferric chloride test for phenols was negative and the carbylamine reaction mildly positive. Ammoniacal silver nitrate was reduced slightly.

Attempts to use barium acetate in place of lead acetate and sodium hydroxide in place of ammonium hydroxide gave negative results. This is interpreted as indicating that the precipitation of the vitamin by lead at a pH of 7.4 to 7.6 is a more or less specific adsorption phenomenon.

The alcohol-ether preparation was finally purified still further by evaporating to dryness in vacuo and extracting the residue with absolute ether. This removed a significant amount of amorphous material, leaving the total solids of the active fraction equivalent to 0.28 mg. per cubic centimeter of lemon juice.

The vitamin D problem.—I, The photochemical reactions of ergosterol, E. H. REERINK and A. VAN WIJK (*Biochem. Jour.*, 23 (1929), No. 6, pp. 1294-1307, figs. 17).—This has been noted essentially from another source (*E. S. R.*, 62, p. 502). In addition to spectrographic data, a preliminary report is given of the biological tests conducted on rats with the various preparations. The most active substance formed on long-wave irradiation was able to cure a rat of rickets in 14 days in a daily dosage of 0.00001 mg. It is estimated that about 50 per cent of this preparation consisted of vitamin D. All samples exposed to short-wave irradiation had an activity of 0.1 or less of the best sample of ergosterol exposed to long-wave irradiation.

In the treatment of infantile rickets with a preparation of ergosterol exposed to long-wave irradiation and containing about 30 per cent of vitamin D, complete healing is said to have been obtained in all cases within 14 days by a daily dosage of 0.04 mg.

Fractionation studies on provitamin D, F. C. and E. M. KOCH and I. K. RAGINS (*Jour. Biol. Chem.*, 85 (1929), No. 1, pp. 141-158).—A commercial ergosterol-containing cholesterol obtained from spinal cord was purified by four different methods, and the various preparations were then irradiated and tested for activity by biological tests and for the presence of ergosterol by spectrum analysis.

All of the purified cholesterol, though apparently free from ergosterol, still possessed a provitamin D activity amounting to about $\frac{1}{10}$ to $\frac{1}{25}$ that of the commercial product used. Attempts to purify the various products still further by sublimation under diminished pressure in nitrogen resulted in a marked increase in the provitamin D activity of both the sublimate and the nonsublimable residue. The best conditions for increasing the amount of provitamin D by heat treatment were found to be heating with little or no oxygen at temperatures slightly above the melting point for periods of from 1 to 3 hours. Coincident with changes in antirachitic activatability changes in melting point, absorption spectra, and optical rotation were observed, but no chemical changes such as could be detected by color reactions, iodine number estimations, or refractive index readings. "We conclude that provitamin D activity is not limited to ergosterol, but that it may be a general property in varying degrees of various sterols or certain forms of those sterols."

Absorption spectra studies on cholesterol and ergosterol, E. M. and F. C. KOCH and H. B. LEMON (*Jour. Biol. Chem.*, 85 (1929), No. 1, pp. 159-167, pls. 4, fig. 1).—This is the report of the spectrum analyses of the various products tested in the investigation noted above. The original commercial preparation of spinal cord cholesterol studied showed the four typical absorption bands of ergosterol. The purified products, which still retained some activatability, showed no absorption bands corresponding to ergosterol and no general absorption in the ultra-violet region. The heated products showing increased activatability exhibited a strong general absorption spectrum in the ultra-violet region but no specific bands. Plates are given of the various absorption spectra.

The oxidation of xanthates and some new dialkyl sulphur- and disulphur-dicarbothionates, A. CAMBRON and G. S. WHITBY (*Canad. Jour. Research*, 2 (1930), No. 2, pp. 144-152).—Sodium tetrathionate and cyanogen bromide in water were found to have a specific oxidizing action on alkali xanthates, the latter being smoothly converted to xanthogen disulfides without the formation of by-products. Cyanogen bromide in alcohol converted xanthates into xanthogen monosulfides. Other new reagents used for the oxidation of xanthates to xanthogen disulfides under certain conditions were nitrous acid, nitrosyl chloride, chloramine-T, benzene sulfonyl chloride.

The new xanthogen disulfides, *n*-hexyl (liquid), β -ethoxyethyl (liquid), β -phenylethyl (m. p. 49.5-50°), and the new xanthogen monosulfides, *n*-hexyl (liquid), benzyl (m. p. 82.5°), β -ethoxyethyl (liquid), are described. β -phenylethyl xanthogenamide (m. p. 79°) is also described. Pyrolysis of β -phenylethyl xanthogen disulfides yielded styrene.

A new method for measuring osmotic pressure, R. V. TOWNEND (*Diss., Johns Hopkins Univ., Baltimore, 1927, pp. 11, fig. 1*).—In principle the method is as follows: The solution to be measured is placed in contact with its vapor, this vapor being in contact also with the surface of the pure solvent. The

temperature being the same throughout the system, pure solvent will distill into the solution, and "the vapor phase may be regarded as a perfect semi-permeable membrane permitting the passage of the molecules of solvent only.

"In order to permit the measurement of the osmotic pressure the liquid water is located within the capillaries of a thin porous plate. The capillaries are of sufficient size to permit the liquid water to pass readily to the surface of the plate, but so small that the maximum capillary rise is somewhat greater than the maximum osmotic pressure to be measured. Below the plate is a quantity of liquid water and below this a column of mercury. The weight of the water and mercury places a tension on the water at the surface of the plate. At equilibrium this force (corrected for any difference in heights between the water and solution) equals the osmotic pressure of the solution. The equilibrium point is determined by measuring the rates of distillation from the plate to the solution under different tensions. These rates are plotted against the corresponding tensions. The osmotic pressure, which corresponds to the tension at zero distillation, is obtained from the curve by extrapolating to zero."

Equipment for gas-liquid reactions, D. B. KEYES (*Ill. Univ. Engin. Expt. Sta. Circ. 19* (1929), pp. 14, figs. 11).—A total of 12 types of apparatus are described and illustrated under the four group captions of columns, high-speed stirrers, stationary slits, and elongated slits with one side in motion. The columns include simple spray, filled, whirling spray, perforated plate, and bubble cap plate types; the high-speed stirrer tested was designed to cause the gas to issue from between the edges of two disks placed close together and very rapidly revolved; the stationary slits included a right-angle tube type, a simple slit apparatus, and types utilizing elongated narrow openings; and the last-named group of apparatus depended upon rotating disks and rotating cone slits. All these types are shown in diagram, and their relative effectiveness is briefly discussed.

On the dehydration of analytical precipitates by ignition [trans. title], W. MIEHR, P. KOCH, and J. KRATZERT (*Ztschr. Angew. Chem.*, 43 (1930), No. 12, pp. 250-254, figs. 2).—The experimental work reported concerned the behavior or ignition of aluminum hydroxide, of aluminum phosphate, and of precipitated silicic acid.

Aluminum oxide was found to require ignition at a temperature of at least 1,200° C., better 1,300°. temperatures stated not to be attained with the ordinary gas-air blast lamp. The ignited oxide should increase in weight in a calcium chloride desiccator at most by only a few tenths per cent. The ignited oxide should take up alizarin to the extent at most of a trace of color. The use as a check of a standard preparation of aluminum oxide known to have been thoroughly ignited is suggested. An ignited precipitate which did not meet these specifications was found to give analytical results at least 0.8 per cent high, and varying with the ignition and coloring procedures up to 3 or 4 per cent too high.

In the case of aluminum phosphate precipitates a temperature of 1,350° resulted in a noticeable loss of phosphoric anhydride, but ignition with the ordinary blast lamp permitted the precipitate to retain about 1 per cent of water. The best results with aluminum phosphate were obtained at ignition temperatures of from 1,200 to 1,300°, it being unnecessary even at the latter temperature to avoid prolonged ignition, since loss of phosphoric anhydride was not found to occur at 1,300°. A temperature higher than 1,300° was found dangerous, however.

In the case of the silica the figures given show a water content of 0.9 per cent after ignition for 1 hour at 900° and 0.5 hour in the desiccator 0.5

after like ignition at 1,000°, 0.2 per cent at 1,100°, and 0.0 per cent at 1,200 or 1,300°. In the two cases last named the water content had risen only to 0.2 per cent after 20 hours in the desiccator.

A new micro method for the colorimetric determination of copper [trans. title], C. BENOTT (*Ann. Chim. Analyt.*, 2. ser., 12 (1930), No. 3, pp. 65-69).—In principle, the procedure described consists in the destruction of the organic matter with nitric and sulfuric acids, followed by the precipitation of the copper with hydrogen sulfide, and its conversion into a green complex compound soluble in chloroform by treating the copper in solution with pyridine and ammonium thiocyanate solution. Colorimetric comparison is made of the chloroform solution of the copper compound obtained from the sample with a similarly prepared standard of known copper content.

The determination of traces of iodine, I, II, (*Jour. Amer. Chem. Soc.*, 50 (1928), No. 4, pp. 1093-1099, figs. 3; 51 (1929), No. 2, pp. 394-399, fig. 1).—These two papers are contributions from the Laboratory of Physiological Chemistry, University of Minnesota, and from the same laboratory with the cooperation of the South Carolina Food Research Commission, respectively.

Part I, by J. F. McClendon.—The apparatus for burning the sample consisted essentially of a silica tube 9 cm. in diameter of bore and 60 cm. long provided with a 2.5 by 30 cm. elbow passing vertically downward into a Pyrex absorption flask containing 0.1 gm. of sodium hydroxide in 500 cc. of distilled water and cooled by immersion in ice water. The joint between the combustion tube and the flask was packed air-tight with wet asbestos. A side neck of the absorption flask connected the assembly through a Cottrell precipitator, operated by a Ford spark coil, to the suction. The tube was heated by a row of large Méker burners, oxygen was supplied at the open end of the tube, and the sample to be burned was fed in slowly upon strips of sheet iron, or, in the case of oils, sprayed into the open end of the combustion tube. The subsequent determination of iodine is thus described.

"The ash is extracted with water, or if it contains a large amount of water soluble salts with absolute alcohol (free from aldehyde) in a ball mill. Sufficient alcohol is used to permit decantation after the extraction, and the extraction is repeated several times. The combined extracts are filtered and evaporated. The residue is dissolved in about 2 cc. of water and analyzed separately or after addition to the sodium hydroxide solution and washings.

"In the iodine analysis, the solution is neutralized with phosphoric acid (to which $\frac{1}{2}$ volume of 0.1 N sulfurous acid has been added) using an indicator paper made by drying an alcoholic solution of methyl orange or bromophenol blue on ash-free filter paper. It is heated to boiling to expel carbon dioxide and sulfur dioxide and cooled. The volume is now made up to 10 cc. and the solution transferred to a 12-cc. separatory funnel (preferably with a 10-cc. graduation mark for making up to volume). One cc. of purified carbon tetrachloride and 1 or 2 mg. of sodium nitrite are added and the separatory funnel is shaken 100 times; during the shaking $\frac{85}{95}$ of the iodine should pass into the carbon tetrachloride and color it pink or violet, so that by multiplying the yield by 1.118 the total iodine in the sample may be calculated. The carbon tetrachloride is cloudy with water droplets and is run into a 1-cc. glass-stoppered bottle and centrifuged in the special centrifuge head shown. . . . It is then run into the left cup of the . . . microcolorimeter shown. . . . Carbon tetrachloride containing pure iodine of the concentration 0.1 mg. per cubic centimeter is placed in the right cup and a color match made. Ten readings are made and their average is taken. The reading in millimeters divided by 200 and multiplied by 1.118 gives the milligrams of iodine."

II. *Iodine in vegetables*, J. F. McClendon and R. E. Remington.—Vegetables or other samples capable of like treatment are formed into sticks and slowly advanced into the combustion tube from a steel tube fitted with a screw piston. In other respects the combustion and absorption apparatus are very similar to those above noted, and essentially the same analytical procedure follows.

Experiments with final molasses, J. A. McDONALD (*Mem. Imp. Col. Trop. Agr., Trinidad. Sugar Technol. Ser. No. 2, (1930), pp. 7, fig. 1*).—A surface tension method for analysis is given, its limitations are noted, and the significance of the results is discussed.

The ratio between total ash and conductivity was fairly constant, especially in solutions diluted to about 4° Brix. A glucose-ash ratio below 1.9 was found to indicate a final product of high purity. Viscosity rose sharply with decrease in temperature, especially between 50 and 25° C. The significance of colloid content and of Brix scale density readings was also studied.

A comparison of the modified Babcock and the Mojonnier methods for butterfat in ice cream, E. S. CHASE and F. G. KING (*Jour. Dairy Sci., 12 (1929), No. 6, pp. 473-480*).—In this study the authors found that 45 per cent of the modified Babcock tests for determining the butterfat content of ice cream checked with the Mojonnier test. Within ± 0.2 per cent, 86 per cent of the Babcock tests were satisfactory. No reason could be given for the 14 per cent failing to check within the ± 0.2 per cent. The maximum variation of the two methods was about 0.5 per cent. On the whole, the Babcock tests averaged 0.04 per cent higher than the Mojonnier tests.

The use of the Mojonnier milk tester for the routine determination of vanillin with preliminary discussion of the Towt lead number, L. V. TOWT (*Jour. Dairy Sci., 12 (1929), No. 6, pp. 469-472*).—The author describes a simple and very accurate method for determining the vanillin content and for estimating the bean content of vanilla extracts, in which the Mojonnier milk tester was used.

Chemistry and analysis of the permitted coal-tar food dyes ponceau SX, sunset yellow FCF, and brilliant blue FCF, O. L. EVENSON and H. T. HERRICK (*U. S. Dept. Agr. Bul. 1390 (1930), Sup. 1, pp. 8*).—This is a brief statement of the constitution, method of preparation, and of certain of the properties of the three dyes named, with which is given also some account of the nature and quality of the intermediates necessary to the manufacture of the dyes. Specifications and chemical tests for the three new dyes, and chemical tests only for lead and for amaranth and ponceau 3R, yellow AB, and yellow OB (E. S. R., 55, p. 112) are briefly stated.

METEOROLOGY

Monthly Weather Review, [November–December, 1929] (*U. S. Mo. Weather Rev., 57 (1929), Nos. 11, p. 449-490, pls. 11, figs. 11; 12, pp. 491-531, pls. 16, figs. 8*).—In addition to detailed summaries of meteorological and climatological data and weather conditions for November and December, 1929, and bibliographical information, notes, abstracts, and reviews, these numbers contain the following contributions:

No. 11.—The Long Dry Season of 1929 in the Far West, by E. H. Bowie (pp. 449-451); Weather and Cotton Yield in Texas, 1899-1929, Inclusive (illus.), by L. E. Daingerfield (pp. 451-453) (see p. 809); Relations between Summers in India and Winters in Canada (illus.), by F. Groissmayr, with discussion by C. F. Brooks (pp. 453-455); The Influence of the Weather Factors in India on the Following Winter in Canada, by F. Groissmayr, trans. by W. W. Reed,

abs. by C. F. Brooks (pp. 455, 456); The Daily March of Temperature and Humidity (illus.), by V. E. Shelford (pp. 456-459); A Tropical Cyclone in Southern California, by D. Blake (pp. 459, 460); Sleet and Snow at Unusually High Temperature, by J. P. McAuliffe, with discussion by L. T. Samuels (p. 460); Chemical Composition of Rains and Snows at Mount Vernon, Iowa, by L. Kynett and J. Löhner (p. 461); Areal Rainfall Estimates (illus.), by E. N. Whitney (pp. 462, 463); A Correlation between Solar Radiation Intensities and Relative Humidities, by P. R. Gast (pp. 464, 465); Solar Radiation and Relative Humidity in Relation to Duff Moisture and Forest Fire Hazard (illus.), by P. R. Gast and P. W. Stickel (pp. 466-468); Duration of Rainfall at Havre, Montana (illus.), by F. A. Math (pp. 468-471); and Utilization of Fixed Searchlights in Measuring Cloud Heights (illus.), by I. F. Hand (pp. 471, 472).

No. 12.—Professor Exner on the Circulation of Cold and Warm Air between High and Low Latitudes (illus.), by A. J. Henry, condensed from trans. by W. W. Reed (pp. 491-498); The Weather Situation in Europe in the Winter of 1928-29, by F. M. Exner, trans. by W. W. Reed (pp. 498, 499); Nocturnal Temperature Inversions Near the Gulf Coast, by R. A. Dyke (pp. 500-502); Weather Problems Peculiar to the New York-Chicago Airway, by W. L. Smith (pp. 503-506); Exposure of Rain Gages, by B. R. Laskowski (pp. 506, 507); A Factor in the Temperature of the Stratosphere, by W. J. Humphreys (pp. 507, 508); Ice Storm of December 17-18, 1929, at Buffalo, N. Y. (illus.), by J. H. Spencer (pp. 508, 509); Hailstorms of 1929 in the United States, by S. D. Flora (pp. 509, 510); Preliminary Statement of Tornadoes in the United States during 1929, by H. C. Hunter (p. 510); Cycle Recurrences with Variable Length of Both Period and Amplitude (illus.), by C. F. Marvin (pp. 510, 511); The Weather of 1929 in the United States (illus.), by A. J. Henry (p. 511, 512); and Chart of Tropical Storms of the Western North Atlantic, 1928-1929, inclusive, by W. P. Day.

Weather and cotton yield in Texas, 1899-1929, inclusive, L. H. DAIN-GERFIELD (*U. S. Mo. Weather Rev.*, 57 (1929), No. 11, pp. 451-453, fig. 1).—Data for temperature, precipitation, killing frosts, and boll weevil damage in Texas are summarized. It is pointed out that the great area of the State and its varied climatic conditions, especially the marked zonal distribution of rainfall, greatly complicate the correlation of weather and cotton yields.

The general conclusion reached is that "other things being equal, the ideal year for cotton would be one in which there was good soil-moisture storage during the preceding winter, which should be sufficiently cold to destroy the hibernating pests; followed by an early spring of moderate rainfall, promoting planting and cultivation of crop; a moderately dry, hot summer, with abundant sunshine, but not really droughty and not subject to sharp reversals in rainfall or temperature, thus favoring care and growth of crop and holding down weevil (this condition would favor certain other insects, however, of less serious nature). Finally, a fairly dry, bright autumn and late frost, to remove all of the cotton from the fields without deterioration or loss."

Meteorological observations, [January-February, 1930], C. I. GUNNESS and D. F. MURPHY (*Massachusetts Sta. Met. Ser. Buls.* 493-494 (1930), pp. 4 each).—Observations at Amherst, Mass., are summarized and briefly commented upon.

SOILS—FERTILIZERS

The maintenance of soil fertility, C. E. THORNE (*New York: Orange Judd Pub. Co.; London: Kegan Paul, Trench Trubner & Co., 1930 pp. XVII+332, pl. 1, figs. 28*).—This book epitomizes the results and teachings of the long-continued experiments of the author and his associates at the Ohio Experiment

Station, taking account also of the results of similar experiments elsewhere, as for example, the work at Rothamsted and Woburn in England and that carried on continuously at the Pennsylvania Experiment Station since 1882. It is therefore the work of one who has been an active participant in investigations which have made a large contribution to the basic facts discussed, confined "chiefly to results obtained in experiments of considerable duration made on a few representative soils."

The scope of the book is indicated by the chapter headings as follows: The soil; soils of the United States; an outline of farm chemistry; soil organisms and their function; the composition of the plant; the mechanism of plant growth; drainage, irrigation, and tillage; the function of lime in the soil; field experiments in liming the land; practical problems in liming the land; phosphorus, the yoke-mate of lime; raw phosphate; potassium; nitrogen; maintaining the yield in single cropping; the search for cheaper nitrogen; nitrogen purveying crops; how much nitrogen will clover furnish; commercial carriers of nitrogen; barnyard manure; the production, conservation, and reinforcement of manure; the distribution of fertilizers or manure in rotative cropping; the home-mixing of fertilizers; green manuring; fertilizing the orchard; fertilizing the pasture; fertilizing truck crops; and review and practical applications. An appendix gives a summary of experiments in liming and fertilizing field crops grown in rotation.

In his preface the author states that if "it may seem that in this volume special stress is laid upon the work of the experiment field rather than upon that of the laboratory, it is not because of lack of appreciation of laboratory research, but because of the desire to interpret the results of that research in terms of actual farm practice" under varying conditions of soil and season. He feels that "effective field experimentation is still in its infancy," but that the work thus far accomplished "has demonstrated that the farmer now has it in his power very materially to increase the yield of the acre, and at the same time to reduce the unit cost of production."

Principles of soil technology, P. EMERSON (New York: Macmillan Co., 1930, pp. XV+402, [pl. 1], figs. [42]).—"The writer has aimed to correlate the facts of soil knowledge and present the science from the teaching standpoint in as fundamental a manner as possible."

The captions of part 1 are the properties and functions of soil, soil formation, soil genesis, soil morphology, soil classification, and soil areas of the United States; of part 2, the physical formation of soil, soil texture, soil colloids, soil air, soil temperature, soil water, physical properties of the soil mass, and physical properties and plant growth; of part 3, soil composition, the chemical properties of soils, soil reaction, organic matter, the soil solution, and the chemical and physical properties of soils in relation to plant growth; and of part 4, soil life, the function of the microorganic soil population, factors influencing the biological functions in soils, biological functions and plant growth, and soil cycles. An appendix contains soil charts, tables of chemical and mechanical composition of soils, a glossary of terms, and author and subject indexes.

The nature and properties of soils, T. L. LYON and H. O. BUCKMAN (New York: Macmillan Co., 1929, rev., pp. XIV+428, [pls. 2], figs. 31).—This is a revised and abridged edition of this well-known text (E. S. R., 47, p. 317).

[Rice soil work at the Arkansas Station] (Arkansas Sta. Bul. 246 (1929), pp. 34, 31-33).—Several studies are noted.

Effect of nitrogenous fertilizers on physical condition of rice soil, W. H. Metzger.—The lack of favorable response of rice to even an initial fertiliza-

tion with sodium nitrate is not thought to be due to its effect on the physical condition of the soil.

Effect of irrigation on reaction and availability of phosphorus in rice soils, R. P. Bartholomew.—Irrigation water from limestone wells has reduced the acidity of the soils under observation, in some instances rendering them alkaline. Irrigation with such waters was found to bring from 98 to 300 lbs. of calcium and from 30 to 60 lbs. of soluble iron and aluminum to each acre of irrigated soil annually. It is further stated that "results from studies made on the effect of irrigation on the water soluble phosphorus in rice soils show that much of the inorganic water-soluble phosphates are converted into organic phosphorus compounds which are unavailable for plant nutrition."

Base exchange and the availability of calcium, potassium, and magnesium in rice soil, W. H. Metzger.—Detailed findings with respect to the conditions in the A, B, and C horizons are stated.

The effect of moisture content and cropping on exchangeable calcium and magnesium, W. H. Metzger.—"Crowley silt loam cropped to rice for 15 of the past 20 years showed considerably more exchangeable calcium and magnesium in the surface soil than in the subsurface horizon. Keeping Clarksville silt loam at a moisture content of 20 per cent with distilled water for a period of 75 days increased the exchangeable magnesium as compared with the same soil kept air-dry. Exchangeable calcium was not appreciably changed. Flooding with distilled water for the same period of time depressed the amount of exchangeable calcium, but increased the amount of exchangeable magnesium." Cropping to corn for one season was not shown to have any measurable effect upon the exchangeable calcium and magnesium of a silt loam soil.

The soils of the Libyan oases, R. R. LE G. WORSLEY (*Egypt Min. Agr., Tech. and Sci. Serv. Bul.* 91 (1930), pp. 27, figs. 10).—"Sufficient samples were collected to indicate the nature of these soils with some degree of accuracy, and in the case of Dakhla oasis, and perhaps Bahariya, the number and variety of positions of the samples were sufficient to provide an approximate soil survey of the cultivated areas."

All of the soils were found to have an alkaline reaction, although "they have lower pH than Nile Valley soils in general, due to the soluble salt content being higher. Most of the soils are very sandy; those from south Kharga and most of Dakhla, however, are alluvial deposits containing appreciable quantities of clay and bearing a strong resemblance to Nile silt, being classed under the heading of heavy soils. The pH of the sandy soils are normal for Egypt, considering their composition, but the pH of the heavy soils are considerably below these of corresponding Nile Valley soils. A suggested explanation is the probable presence of alum, phosphates, or substances of an acid nature which are actually found in quantity in parts of these oases."

A soil survey of Block E (Renmark) and Ral Ral (Chaffey) irrigation areas, J. K. TAYLOR and H. N. ENGLAND (*Aust. Council Sci. and Indus. Research Bul.* 42 (1929), pp. 51, pl. 1, figs. 8).—"The topics taken up include the general characteristics of the Renmark irrigation area in South Australia; the origin of Block E soils; the soil survey field methods employed; the laboratory work, including the chemical and the mechanical analyses: "the significance of the 1917 flood line; hardpans; wind-swept areas; soil types in relation to irrigation and drainage;" and, in the form of an appendix, the analytical data obtained.

The soil reaction profile, E. A. NORTON and R. H. BRAY (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 8 pp. 834-844).—The paper is an account of findings with respect to local soil conditions and is a contribution from the Illinois Experiment

Station. The four groups of materials examined included 4 mature soils, 3 "slick spot" soils, 4 immature soils, and 3 young or undeveloped soils.

The A₁ horizon of the Illinois soils was found to attain at an early stage in soil formation a pH value of about 5.7, "which seems to be a position of equilibrium between the accumulation of bases from the decay of organic matter and the loss of bases by leaching." This reaction was found to be "maintained as long as the soil is able to support a good vegetative growth," and it is considered that the productive soil of the region must have been able to maintain this reaction in the uncultivated soil. The observations recorded lead also to the opinion that "the highest acidity which might be expected in the mature soils . . . is a pH of about 4.8" under the present local conditions.

The soils of rolling, well drained areas were found more acid throughout the profile than those of flat areas developed under conditions of poor drainage.

The pH values in the slick spot profiles showed a good correlation with the texture, structure, and consistence characteristics and with the replaceable sodium content found.

It is concluded that "the reaction profile is a relatively stable soil character, and that it can be considered as an aid to the separation of soil types."

Prevention of soil erosion in new clearings, C. C. DU PRÉ MOORE (*Trop. Agr. [Ceylon]*, 72 (1929), No. 2, pp. 67, 68, pl. 1).—The system advocated and found very successful is that of contour trenches (as opposed to drains). The earth from these is used to level the terrace above the trench and in forming an earth and stone "bund" along the upper margin of the contour trench to assist in retaining the terrace. The system also contemplates the uprooting, rather than the burning, of grass in the opening of new lands, the grass being left on the surface to rot down and increase the soil organic matter. A diagram and photograph illustrate the scheme, which, in the trial here described, was applied to the preparation of new land for tea culture.

Soil erosion, F. D. TILL (*Trop. Agr. [Ceylon]*, 73 (1929), No. 6, pp. 363-365, pl. 1).—The author finds the platform terrace system for the prevention of erosion to have the following disadvantages: (1) The pocketing and consequent check to the growth of the planted product; (2) lack of moisture at the roots of the young plants during the first few years; (3) the expense of the system, should dense planting be resorted to; (4) insecure anchorage of trees on steep land or, alternatively, delay of the plant's root system in reaching the best soil; and (5) impracticability of using a quick-acting fertilizer with any benefit in the first few years unless expensively large holes are cut for the plant.

It is admitted that the platform terrace is effective in checking erosion, but it is considered that the contour trench is equally effective and obviates the enumerated drawbacks of the platform terrace system.

Soil moisture report of February 15, 1930, H. H. FINNELL ([*Oklahoma*] *Panhandle Sta., Panhandle Bul.* 14 (1930), p. 14).—Local conditions are discussed.

The degree of significance which such data are considered to possess with respect to forthcoming cropping conditions is indicated in the statement that "these observations were made on silty clay loam which is typical of the major portion of the wheat-producing area of this region. While it is true that the initial moisture is less than one-fourth as important as the seasonal rainfall to follow in determining the outcome of spring sown small grains, it is nevertheless the most important factor upon which it is possible to base any sort of forecast as to crop possibilities."

When the soil mulch conserves moisture, C. F. SHAW (*Jour. Amer. Soc. Agron.*, 21 (1929) No. 12, pp. 1165-1171, fig. 1).—The soil used in these experi-

ments of the California Experiment Station (Yolo sandy loam) was tamped down, with care to avoid stratification and to secure an even volume weight of 1.15, in galvanized iron tubes 8 in. in diameter and 4 ft. long. The soil had a moisture equivalent of 16 and a 3 per cent moisture content. Constant water level and a constant flow of air over the surface of the soil tubes was provided, and a period of several months after setting up was allowed for the establishment of equilibrium conditions before the mulch experiments themselves were undertaken.

The results obtained are detailed numerically and graphically, and conclusions are presented to the effect that when the water table is within easy capillary reach of the surface, the soil mulch reduces the rate of evaporation of moisture from the soil, but in the case of any water table, perched or permanent, lying at a depth such that the capillary rise can not lift the water to the surface "there can be no losses of soil moisture that the mulch can materially reduce." It is pointed out that under such conditions any effort to conserve moisture may be unnecessary, since the root zone will have abundant moisture. "Under arid conditions, alkali accumulations in injurious amounts would ultimately occur," at a rate which might be reduced by effective mulches, but "with high water tables, the soil moisture problem would be that of drainage to get rid of excess water rather than that of mulching to conserve water."

The nitrogen balance in cultivated semiarid western Kansas soils, P. L. GAINER, M. C. SEWELL, and W. L. LATSHAW (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 12, pp. 1180-1185).—The nitrogen contents of the soils of 99 plats at three points of 23, 19.3, and 18.3 in. of precipitation in semiarid western Kansas were determined by the Kansas Experiment Station in 1916 and again in 1927 and 1928. These figures, together with those representing the treatment of the plats, are here presented as the basis of the following conclusions, among others.

The principal factor in nitrogen balance for the period appeared to have been the original nitrogen content, since "a correlation coefficient of 0.64 ± 0.04 was found between the original nitrogen content and changes taking place in the nitrogen content for the entire 99 plats, or for 38 similarly cropped plats the corresponding value was 0.747 ± 0.048 ." Continuous small grains or the alternation of small grain with fallow appeared to cause less change in nitrogen content than did other cropping systems tried, whereas 1 year of grain with 3 years of fallow appeared to occasion very large losses; and either kafir or milo, continuous or alternate with fallow, had a like effect. Finally, "there are indications that when the nitrogen content of the soil in this region falls to approximately 0.1 per cent the factors responsible for additions of nitrogen to the soil will counterbalance those tending to cause its removal, thereby establishing a nitrogen equilibrium near this level." It is considered questionable if so low a nitrogen level would permit maximum utilization of available moisture.

Further evidence concerning the significance of nitrogen in soil organic matter relationships, F. J. SIEVERS (*Jour. Amer. Soc. Agron.*, 22 (1930), No. 1, pp. 10-13).—In this contribution from the Massachusetts Experiment Station, the data recorded continue the history of soil fertility experiments in progress since 1890 and previously dealt with up to 1922 (*E. S. R.*, 48, p. 620).

The data here given "seem to indicate that the nitrogen-carbon ratio of soils is fairly constant; that the nitrogen-carbon ratio of this soil is somewhat wider than for soils in the Pacific Northwest, especially where precipitation is limited; that pronounced variations in soil treatments, even though effective in producing wide differences in yield, had apparently no consistent influence on soil organic matter nor on the nitrogen or carbon content of the soil; that

liming, although it produced regular increases in yield, had apparently little influence on soil organic matter content; that whatever slight increase liming may have produced in soil organic matter, this increase was so directly proportional to the increase in nitrogen and carbon that the ratio between those two elements remained unchanged; [and] that the former conclusion, that there can be no apparent increase in soil organic matter without a proportionate increase in nitrogen, is apparently well founded."

Effect of cultivation on nitrate production and the retention of moisture in soils. R. P. BARTHOLOMEW and W. H. METZGER (*Arkansas Sta. Bul.* 246 (1929), pp. 26, 27).—"The results from the past four years [E. S. R., 58, p. 315; 60, p. 803] show that the different methods of cultivation where the soil is stirred have very little effect if any upon the production of nitrates in soils. The results emphasize the necessity of preventing weed growth in order to conserve nitrates for plant consumption."

Weed growth showed itself wasteful of the moisture supply. Winter cover crops showed themselves capable of taking up about 30 lbs. to the acre of nitrate nitrogen, this representing an annual loss where cover crops are not grown.

Chemical and microbiological principles underlying the transformation of organic matter in stable manure in the soil. S. A. WAKSMAN and R. A. DIEHM (*Jour. Amer. Soc. Agron.*, 21 (1929), No. 8, pp. 795-809, figs 2).—"From three sets of experiments involving controlled feeding of experimental animals, composting experiments, and small scale laboratory experiments on decomposition, the conclusions of the New Jersey Experiment Stations were that "the digestion of the complex organic materials in the feeds involves a diminution of sugars, starches, fats, pentosans, and celluloses, and an increase of the lignins. The nitrogen is excreted by the animal partly in a soluble form, as urea and ammonium carbonate, and partly in a complex organic form, some of which is made up of bodies of microorganisms."

The pentosans and celluloses were found to decompose much more rapidly than did the lignins, so that a fairly rapid accumulation of lignins resulted.

"The rôle of microorganisms in the transformation of manure can be summarized under the processes of decomposition and synthesis both of which take place side by side. From the most readily decomposable sugars to the most resistant lignins all the organic complexes in the manure are acted upon by microorganisms in the decomposition of the manure. Parallel with the decomposition processes, the microorganisms synthesize considerable cell substance, as evidenced by the increase in the protein content, which may form a large part of the actual manure after it has been composted."

Contribution to the chemical composition of peat.—V, **The rôle of microorganisms in peat formation and decomposition.** S. A. WAKSMAN and K. R. STEVENS (*Soil Sci.*, 28 (1929), No. 4, pp. 315-340, figs. 2).—"Two Maine highmoor peats and two lowmoor peats found, respectively, in New Jersey and in the Florida Everglades were studied in this investigation, of which the report here noted continued a New Jersey Experiment Stations series (E. S. R., 61, p. 507) and deals with the occurrence and activities of microorganisms in the peats named.

Microorganisms were found to "play a most important rôle in the formation of peat from the plant remains." In the case of the lowmoor peat bogs the numbers of aerobic bacteria are said to have diminished rapidly with depth, whereas the numbers of anaerobic bacteria increased rapidly with depth. Fungi, aerobic cellulose-decomposing bacteria, and nitrifying bacteria were found in the lowmoor peat at or just below the surface of the bog, diminishing rapidly and disappearing completely at from 75 to 90 cm. from the surface.

At the surface actinomyces were abundant in the lowmoor peat, but these also were found in diminishing quantities at greater depths and disappeared completely at a depth of from 120 to 150 cm.

"Acid sphagnum peat bogs contain an abundant flora of acid-resistant bacteria capable of growing in media of pH 4. In undrained sphagnum peat bogs, the numbers of bacteria, largely anaerobic forms, increase with depth, so that at a depth of 570 cm. there were found more bacteria growing on synthetic agar media than in the surface layers of the bog.

"The rate of decomposition of peat, as shown by the evolution of CO_2 , is much slower than that of fresh plant residues. With an increase in depth of peat there is a widening of the ratio (C/N) between the carbon liberated as CO_2 and the nitrogen liberated as ammonia and nitrate. The deeper the lowmoor peat the less active is its nitrifying capacity. Certain pure cultures of fungi and actinomyces can decompose sterilized lowmoor peat as fast as the total soil population. The addition of inorganic nitrogen salt and phosphates had practically no effect upon the rapidity of decomposition of lowmoor and highmoor peats, because available energy and not nitrogen is the limiting factor in the decomposition of peat material. The ratio between the CO_2 and nitrogen liberated (C/N) in the course of peat decomposition is wider in the case of the highmoor sphagnum peats than in lowmoor peats.

"Treatment of peat with ether, toluene, and dilute hydrochloric acid followed by the removal of the reagent leads to a very marked increase in the rapidity of the peat decomposition. The action of ether and toluene is not due so much to any change in balance of the microbial population of peat as to the removal of waxy substances rendering the peat more readily available for the action of microorganisms. Different treatments differ markedly in the nature of their action upon peat, because different organic complexes in the peat are affected by each treatment."

The effects of green manures and cover crops on soil moisture, A. W. R. JOACHIM and S. KANDIAH (*Trop. Agr. [Ceylon]*, 74 (1930), No. 1, pp. 3-9).—The results of moisture determinations on soil samples taken at various depths up to 24 in. from tree, bush green manure, and cover plats at the experiment station at Peradeniya during 1928 and 1929 confirmed generally the results of previous work (E. S. R., 58, p. 816) on the relation of cover crops to soil moisture. The following conclusions appeared also to be indicated.

"In the case of the tree green manure plats the shade afforded by the trees, where good, appears to be an important factor in counterbalancing losses of soil moisture by transpiration from the leaves and from the soil surface by evaporation provided the drought is not too prolonged. . . . Green manure loppings should not be turned into the soil prior to or during dry weather or great soil moisture losses will result. The most suitable time for lopping the trees and forking in the loppings appears to be toward the end of the rains when dry weather is likely to alternate with wet. This will result in speedy decomposition of the loppings in the soil and will increase the moisture-retaining capacity of the latter. In dry districts it is preferable to lop the green manure trees before the drought sets in and to leave the loppings as a mulch on the surface.

"Bush green manures should be treated similarly to the tree green manures, but they should not be allowed to continue to grow during periods of drought, as the shade they afford does not appear to counteract losses of soil moisture through transpiration.

"Soils planted to cover crops either periodically cut or left uncut are found to retain more moisture than bare soils at nearly all depths up to 24 in. The results of previous work on the subject are therefore confirmed."

The relation of green manures to the carbon and nitrogen contents and reaction of soils at Peradeniya, A. W. R. JOACHIM and D. G. PANDITSEKERE (*Trop. Agr. [Ceylon]*, 74 (1930), No. 1, pp. 10-14).—Carbon and nitrogen determinations upon soils from the permanent green manure plats at the experiment station at Peradeniya appeared to indicate but slight carbon and nitrogen losses from plats upon which green manure crops were grown or plowed under, whereas "appreciable losses of these constituents from the control plats" were observed "even though the latter are uncultivated."

The losses from the green manure plats were so small "that it may be stated that the carbon and nitrogen contents are being maintained by the use of green manures." The carbon:nitrogen ratios were found to be about 10:1. Determinations of H-ion concentrations indicated a lowering of the soil acidity as a result of the growing of the green manure crops.

Effect of legumes when grown and disposed of in various ways, M. NELSON (*Arkansas Sta. Bul.* 246 (1929), pp. 17-19).—Tests for the most part of the usual type are reported in detail. The legumes were grown one year followed by corn, and corn was used as trial crop the second year. The experiment has covered eight years during which time the legumes have been grown four seasons on the same plats alternating with four trial crops. The land used was of medium fertility, producing in check plats about 30 bu. of corn per acre.

"The average values of crops for the 8-year period show clearly that the practices of converting the legumes into hay gave the highest average value per year of crops produced, except in the case where soybeans were grown after oats. Where crops of legumes were grown and plowed under, thus giving back to the soil all that it produced that season, the value of the corn yields realized only in alternate years had to stand as the returns for a 2-year period. The average value on this basis still exceeded the average from checks by more than \$3 per acre. The results of the experiment indicate decisively the advantage of legumes in respect to increase in yields of succeeding crops and average value of crops produced by these different methods."

The use of bacteriostatic dyes in the isolation of *Rhizobium leguminosarum* Frank, I. A. ANDERSON (*Soil Sci.*, 28 (1929), No. 4, pp. 305-313).—The dyes given trial in the experiments recorded in this contribution from the Idaho Experiment Station included safranin, eosin Y, rose bengal, crystal violet, malachite green, and rosaniline hydrochloride. Of these only crystal violet, the rosaniline salt, and malachite green gave especially promising results, crystal violet proving most effective in the methods described.

The experimental work and the technic developed are detailed. As conclusions it is stated "(1) that subjecting *R. leguminosarum* to severe treatment with dyes does not in anyway affect the ability of the legume root nodule-producing bacteria to produce nodules on the species of plants from which they were originally isolated. This was arrived at by observing that cultures recovered from dye plates which almost entirely inhibited all growth were still able to produce nodules on the plants. (2) Such a method of isolating *R. leguminosarum* is possible and practicable through the use of crystal violet dissolved in Ashby's agar in concentrations of 1 part of dye to 10,000 of medium, down to 1 part of dye to 15,000 parts of medium. This method was found so simple and convenient that beginning students in bacteriology could get successful results in their first trials. (3) Other dyes which gave promising results, although not so clear-cut as the results with crystal violet, were rosaniline hydrochloride and malachite green."

Decomposition of citric acid by soil, L. A. and A. L. DEAN (*Soil Sci.*, 28 (1929), No. 4, pp. 281-287, pl. 1, fig. 1).—A study of the Dyer method for deter-

mining available soil phosphates by extraction with 1 per cent of citric acid is reported from the Experiment Station of the Association of Hawaiian Pineapple Cannery, University of Hawaii. An examination by this method of 272 Hawaiian pineapple soils showed that soils yielding as much as 100 parts per million of citric acid soluble phosphoric anhydride were comparatively rare. On the other hand, no general indications of phosphate deficiency could be observed in these soils. Also, the addition of rock phosphate and of superphosphate in quantities such as to add in each case 200 parts per million of total phosphoric anhydride, though it caused a marked increase in the apparent available phosphate in some soils, brought about only small and irregular increases in certain highly manganiferous soils, and, in fact, "indicated no consistent behavior on the part of the high manganese soils." Further evidence suggestive of a decomposition of the citric acid in certain of the soils examined was obtained in the determination of the final pH values of the citric acid extracts of a number of samples, the figures ranging from pH 2.3 to pH 6; and finally it was found that a large evolution of carbon dioxide took place during the citric acid treatment, whereas hydrochloric acid treatment yielded little or no carbon dioxide.

The possibility of biological production of carbon dioxide was excluded by sterilization, and it was determined that a 40-gm. sample of the soil with 400 cc. of water and 4 gm. of citric acid could yield as much as 0.4767 gm. of carbon dioxide in four hours, as against 0.0016 gm. yielded by a corresponding hydrochloric acid treatment. A distillate from the soil citric acid reaction mixture gave positive evidence of the presence of acetone in the formation of iodoform in the Gunning test and in yielding dibenzylacetone.

From these results it was concluded that some, at least, of the Hawaiian soils are able to decompose citric acid "solutions to such a degree as seriously to affect the value of this solvent." In view of the decomposition of ferric citrate by light with the formation of carbon dioxide and acetone, the appearance of these two decomposition products in the breakdown of citric acid in contact with the soils examined is considered "presumptive evidence of the activity of the iron compounds of the soil."

It was observed, also, that "there is no consistent relation between the amount of phosphorus the cowpeas could remove and that extracted by 1 per cent citric acid. On the other hand, the soil yielding the lowest citric acid extract furnished the most phosphate to the plants, and at the same time had such a destructive action on citric acid that the pH of its 1 per cent solution was raised to 6 during the analytical extraction. The low citric-soluble phosphate of our group of Hawaiian pineapple soils is very possibly related to the loss of acidity of the citric acid during the procedure. However valuable the Dyer method may be as a measure of 'available' phosphate in soils in other countries, we are convinced that it is wholly unreliable under our conditions."

Rôle of potassium. G. JANSSEN and R. P. BARTHOLOMEW (*Arkansas Sta. Bul.* 246 (1929), pp. 27-29).—Investigations into three phases of this subject are noted. The first of these, dealing with the relation of the percentage potassium in plants to the percentage and total amounts of carbohydrate compounds produced, is abstracted on page 819 from another source.

The translocation of potassium in tomato plants and its relation to their carbohydrate and nitrogen distribution.—"Outstanding points were as follows: (1) An increased percentage of dry matter in all parts of the low potassium plants, as compared with high potassium plants, resulted. (2) The total nitrogen and the water-soluble nitrogen were much higher for the low potassium plants than for the high potassium plants. (3) There seems to be an opti-

mum potassium concentration which is conducive to the normal assimilation of carbohydrate compounds, above and below which assimilation is reduced. (4) In potash starved plants the potash seems to be transferred to and localized in the meristematic and growing portions of the plant. There is evidence to indicate that the potassium ion is necessary for cell division. (5) Practically all the potassium is in soluble form. (6) Starvation of the tomato, due to a lack of potassium, is progressive, extending from the lower leaves to the upper leaves. The dead leaves were relatively free from potash, indicating that their potassium had been translocated and reutilized by the growing portions of the plant. (7) Inasmuch as high nitrogen and high sugars are correlated in the blooming stage with low potassium plants, the absence of good growth may have been due to a lack of condensation or polymerization of these compounds to more complex forms."

Luxury consumption of potassium by plants.—From tests very similar in general character to those noted above it was concluded that "plants absorb considerably more potassium during the early periods of growth than is necessary for the normal process of growth. This applies to the crops studied, including alfalfa, Hubam clover, cowpeas, soybeans, oats, wheat, Sudan grass, corn, cotton, and tomatoes. The potassium in the tomato plant is practically all water soluble. Potassium can be translocated within the plant and reutilized to prevent starvation when the supply of available potassium is sufficient to supply the needs of the growing regions. It is suggested that the luxury consumption of potassium, followed by translocation and reutilization of the potassium in the plant, is an important process in the assimilation of potassium by plants."

Lime-magnesia ratios in dolomitic limestones as influencing solution and soil reactions. W. H. MACINTIRE and W. M. SHAW (*Jour. Amer. Soc. Agron.*, 22 (1930), No. 1, pp. 14-27).—Tests were made of the influence of the calcium-magnesium ratio upon the behavior of some dolomites under examination at the Tennessee Experiment Station with respect to the action of carbonated water. The results indicate the following among numerous conclusions and suggestions:

The alkalinity of the extracts increased with the proportion of calcium, and the higher calcium contents appeared to bring about equilibrium more rapidly in carbonated water suspensions. "The addition of economic amounts of dolomite resulted in percolates that contained less calcium and more magnesium than did those from the untreated soil; . . . [but] the correlation of solubility and acid-reaction studies with lysimeter findings apparently justifies the conclusion that, under humid conditions, additions of dolomitic limestone can not produce a toxic condition from an accumulation of magnesium per se, since the outgo of added magnesium exceeds that of added calcium."

The relation between the absorbed and the exchangeable calcium and magnesium content of a soil four years after additions. W. H. MACINTIRE and K. B. SANDERS (*Soil Sci.*, 28 (1929), No. 4, pp. 289-300).—The Hissink method was used to determine the increases in exchangeable calcium-magnesium from surface-zone and subsurface-zone incorporations of high-calcic and high-magnesian limes, limestone, and dolomite separates of a constant 3,570-lb. CaCO_3 equivalence that had been incorporated four years previously in 28 outdoor lysimeters. These findings were compared with the fixation results obtained in the lysimeter studies.

The ratio of calcium to magnesium in the sodium chloride leachings from the original soil, and also that from the exposed controls, was decidedly greater than the one found in the rainwater percolates. The decrease in the exchangeable base content of the lower zone of the controls was materially

greater than that found for the upper zone. Each surface-zone addition caused an extraction of exchangeable bases in excess of that obtained from the surface zone of the original soil. This did not hold for the underlying unlimed zone in the case of the less extensively disintegrated limestone and dolomite separates.

The increases obtained by the Hissink method were uniform for the additions to the lower zone, where both natural leaching losses and carbonate disintegration had been the greater. The increases registered by the Hissink method were consistently less than the absorptions. The average fixation shown by the lysimeter studies for surface-zone incorporations was 79.1 per cent of the constant addition, whereas the increase registered by the Hissink procedure was 63.2 per cent. Corresponding values obtained by the two methods from the subsurface-zone incorporations were 65.3 and 55.9 per cent, respectively. The average absorption from the 13 surface-zone incorporations was 1.25 times the calcium-magnesium increases found by the Hissink method. A corresponding figure of 1.17 was obtained for the subsurface-zone incorporations. Preliminary dispersion failed to increase the recoveries obtained by the Hissink method.

The uniformly higher values for fixation in the lysimeter studies indicated that a fraction of the additions had combined with soil components other than the exchange complex.

AGRICULTURAL BOTANY

The influence of the potash concentration in the culture medium on the production of carbohydrates in plants, G. JANSSEN and R. P. BARTHOLOMEW (*Jour. Agr. Research [U. S.]*, 40 (1930), No. 3, pp. 243-261, figs. 8).—Using plants which have been described as high and low users of potassium, including soybeans, cowpeas, Sudan grass, oats, sweetclover, and corn, and growing them in water, sand, and field soil cultures of differential potassium supply, the authors observed that more potassium was taken from the nutrient solution than was actually needed by the plant in its metabolism. When the percentage of sugars and starch in plants grown in culture solution was totaled it was found that the largest percentage of these substances was present in plants grown in cultures of from 2 to 3 parts per million of potassium, a point below concentration at which the maximum absorption occurred. As measured by dry weight of plants, the largest plant growth occurred in the 2 to 3 parts per million concentration in water cultures.

The authors believe that there is an optimum potassium concentration in the plant associated with maximum carbon dioxide assimilation, and that this optimum changes under different environmental conditions. The relation between percentage of potassium and carbohydrate compounds fluctuates greatly, the usual association of high percentage of sugar and starch with high percentage of potassium not being constant.

High-potassium plants were found more succulent than low-potassium plants. The dry weight per plant decreased with the increase of potassium in the plant or in the nutrient solution. Whether this condition is due to better utilization of nitrogen in the presence of potassium or to the function of potassium in the formation of the precursory carbohydrate compounds, or even to the action of potassium itself, is not known.

The effect of boron on citrus trees, S. M. BROWN (*Citrus Leaves*, 7 (1927), No. 7, pp. 21-23).—Attention was called, in the winter of 1925, to sudden marked injury, beginning with the foliage, in a certain lemon-growing district. This trouble appeared to be due to contamination of the irrigation supply through the admission of waste water from a near-by packing plant where a borax wash

was used as a preservative. The leaves analyzed were found to contain from 400 to 1,700 parts per million of boron, and it was ascertained that a citrus leaf containing more than 200 parts per million will exhibit injury. An account is briefly presented of confirmatory experiments. Boron in some form is present naturally in proximity to the sources of the irrigation supply, and it is, therefore, thought unlikely that the water is the only source of the trouble. Though orange and grapefruit trees are affected, lemon trees appear to be the most sensitive to injury from boron. No sure corrective is yet available.

The cause of blueing in red roses, G. S. CURREY (*Roy. Soc. N. S. Wales, Jour. and Proc.*, 61 (1927), pp. 307-314).—Blueing in red roses is attributed to insufficiency of tannin in the cell sap of the petals. A direct relationship is claimed to exist in red roses between tannin and the anthocyanin pigment, which in the variety Hadley is identical with that in Lady Maureen Stewart and consists of the diglucoside cyanin.

The character of a passage of ash substances into a plant.—I, The reaction of medium as a factor of mineral nutrition of plants [trans. title], D. A. SABININ and S. S. KOLOROVA (*Perm. Selsk. Khoz. Opytn. Sta., Agrokhim. Otd. Rezult. Rabot. (Agr. Expt. Sta. Perm, Dept. Agr. Chem., Results Invest.)*, No. 1 (1927), pp. 91-113, figs. 12; *Eng. abs.*, pp. 105-107).—The reaction of the external solution determines which character of ions shall enter the plant. In acid ranges (pH=4-5), anions (PO_4) enter freely, and in alkaline ranges (pH=7-8), cations (K and Ca) enter readily.

At different periods of development penetration differs. In case of P_2O_5 , an outstanding maximum occurs within the first 3 or 4 weeks of development.

The reaction of the medium affects markedly the growth, development, and crop yield of plants. Maize yielded best at pH=4, less at pH=5, and least at pH=8.

Water utilization of plants under field conditions [trans. title], N. TULAIKOV (*Zhur. Opytn. Agron. Tugo-Vostoka (Jour. Expt. Landw. Südost. Eur.-Russlands*, 5 (1927), No. 1, pp. 3-46; *Ger. abs.*, pp. 45, 46).—This work shows for a given year a certain similarity in the degree of the utilization of water by different plants in different localities and on different soils. Water utilization depends largely upon the amount of precipitation, being higher in moist years. Plants having a longer vegetative period use more of the precipitation. Transpiration coefficients in different plants differ greatly in the same year, but they are higher in dry than in moist years, significantly higher in the early-ripening grains and in beans, and lower in plants having the longer vegetative periods, as winter rye and wheat, maize, sorghum, Sudan grass, millet, and potatoes. Summer wheat showed the highest, and maize and winter rye the lowest, transpiration coefficients. The whole study showed clearly the significance of soil water supply at seeding time for plants having a short growing period and a significantly smaller importance for the late-ripening plants.

An automatic watering system with recorder for use in growing plants, R. A. STEINBERG (*Jour. Agr. Research [U. S.]*, 40 (1930), No. 3, pp. 233-241, figs. 4).—A description is presented of a fully automatic watering system adapted for use in outdoor and indoor studies of plant transpiration and growth when soil moisture is to be kept as constant as possible and a record made of water used. With the apparatus, average soil moisture can be controlled as accurately as necessary by the use of a balance of sufficient sensitivity and horizontal uniformity of soil moisture to ± 1 per cent, while transpiration records accurate to ± 1 per cent were easily obtained.

The vertical growth of trees, II, R. H. CAMBRIDGE (*Roy. Soc. N. S. Wales, Jour. and Proc.*, 61 (1927), pp. 279-284).—The studies previously reported

(E. S. R., 42, p. 348) have been continued, chiefly with trees of the genus *Eucalyptus*, and nothing has been found to modify the views formerly expressed. The results go to show that stem extension is made practically at the summit or growing point and not between the branches.

Correlation between positive antagonism and absorption by plants [trans. title], L. MAUME and J. DULAC (*Compt. Rend. Acad. Sci. [Paris]*, 187 (1928), No. 18, pp. 769-771, fig. 1).—Presenting special phases of work, some of which has been noted (E. S. R., 53, p. 20; 54, p. 516) but not all,¹ the authors state that in the presence of a given quantity of lime, wheat takes up the calcium from its compounds in quantities varying with the concentration of the added element, which acts as inhibitor in regard to the lime.

First studies of the relations between two organisms in attempts made at inducing experimental hemiparasitism between phanerogams [trans. title], S. COLLA (*Ann. Bot. [Rome]*, 17 (1928), No. 5, pp. 308-331, pls. 2).—The experimental portion of this account describes in the first part tests involving the seeding and growth of cereal seeds on tubers of potato (*Solanum tuberosum*), from the comparative study of which are deduced certain conclusions introductory to the second part, in which are described the reciprocal histological reactions which occur between host and parasite, the variations of acidity in the cells of the parasitized tuber, and the formation and localization of ferments in the cereal roots or in the tubers.

Healthy wheat seed germinate in wounds made in potato tubers. The rootlets penetrate into the living parenchyma to various depths, the root hairs certainly absorbing water and possibly nutrients. The potato, in the formation of impermeable tissues, in the segmentation of the cells, in the variation of pH, and in the localization of oxidizing ferments reacts against the roots of the cereals as against a parasitic organism and not as toward a mechanical and indifferent intrusion. The formation of sugar is thought to be due to localized accumulation and chemical action as outlined.

Root tubercles of legumes considered in relation to immunity and morphology [trans. title], C. CAPPELLETTI (*Ann. Bot. [Rome]*, 17 (1928), No. 5, pp. 211-297).—The investigations here particularized showed that the legumes studied could be arranged for the purpose of this study in two general groups, typified respectively by the genera *Lathyrus* and *Phaseolus*, in which nuclear behaviors, as respectively characteristic, are described. The presence of proteolytic enzymes in tubercles of several species, some of which are named, showed a relation to the age of the tubercles.

Bergey's manual of determinative bacteriology, D. H. BERGEY ET AL. (Baltimore: Williams & Wilkins Co., 1930, 3. ed., pp. XVIII+589).—This is a third edition of the work previously noted (E. S. R., 56, p. 326). Besides other additions or alterations indicated, the genera of the tribe Bacterieae have been rearranged and a new key for this tribe has been constructed.

GENETICS

Is evolution a continuous or discontinuous process? F. B. SUMNER (*Sci. Mo.*, 29 (1929), No. 1, pp. 72-78).—The author discusses evolution and considers that the differentiation of species has been a continuous process, though in no case have species been found which differ by only a single genetic factor.

Systematic biology and the mutation theory, G. F. FERRIS (*Quart. Rev. Biol.*, 4 (1929), No. 3, pp. 389-400).—In discussing the systematic classificaton

¹ *Compt. Rend. Soc. Biol. [Paris]*, 95 (1926), No. 20, pp. 23, 24, fig. 1; *Compt. Rend. Acad. Sci. [Paris]*, 184 (1927), Nos. 18, pp. 1081-1083, fig. 1; 20, pp. 1194-1196, fig. 1; 187 (1928), No. 16, pp. 668-670.

of biological material as a basis for explaining how evolution has progressed from similarity of characters of the species, the author points out that the degree of morphological differentiation is invalid as a measure of relationship and as an indication of phylogeny. Such relationships usually exist between closely related species, but single mutations may bring about wide departures in the general characteristics of the new species. Testing the results of the systematist by genetic methods is suggested.

Shaker, a new mutation of the house mouse (*Mus musculus*), E. M. LOED and W. H. GATES (*Amer. Nat.*, 63 (1929), No. 688, pp. 435-442).—A new mutation in the mouse designated as shaker is described. It is expressed in the form of nervous head movements, circling, and deafness. It is controlled by a single recessive factor which is not sex-linked. Linkage relations of this gene were noted by Gates (*E. S. R.*, 62, p. 215).

A blue mutation in the rat (*Mus norvegicus*), E. ROBERTS (*Science*, 70 (1929), No. 1814, p. 834).—In genetic studies with rats at the Illinois Experiment Station two young appeared which were of a light yellowish or reddish gray color. This was evidently due to a recessive dilution factor for black comparable to the so-called blues found in some other mammals.

Genetic factors stimulating mutability of the miniature-gamma wing character of *Drosophila virilis*, M. DEMEREO (*Natl. Acad. Sci. Proc.*, 15 (1929), No. 11, pp. 834-838).—Two genes influencing the mutability of the miniature-gamma gene in *D. virilis* are described. One is a recessive and the other a dominant gene.

Investigations of aberrations of the Y-chromosome in *Drosophila melanogaster* [trans. title]. C. SIERN (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 51 (1929), No. 2, pp. 253-353, pl. 1, figs. 9).—The results of studies of the behavior in breeding tests of flies showing a Y-chromosome breakage with a subsequent attachment of portions of the Y chromosome to an X chromosome are reported.

Hereditary factors in the domestic fowl.—I, The locus of four factors in the X-chromosome [trans. title]. P. HERTWIG and T. RITTERSHAUS (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 51 (1929), No. 2, pp. 354-372, figs. 6).—Using the Barred Plymouth Rock and Orloff game breeds, the results of a study of the linkage between four sex-linked factors, barring (*B*), silver (*S*), rate of feathering (*K*), and a factor for light down color (*Li*), are reported. The crossover percentages calculated were as follows between the different genes: *B* and *K* 40.38 per cent, *S* and *Li* 16.73, *B* and *Li* 42.32, *B* and *S* 44.32, *K* and *Li* 20.18, *K* and *S* 11.36, *S* and *Li* 20 per cent. After giving due consideration to the probable double crossovers, it was estimated on the basis of the linkage relationships that *B* was located near one end of the X chromosome, with *K* about 40 units to the right, *S* 10 units further in the same direction, and *Li* 17 units beyond *S* toward the right end of the chromosome. The data did not indicate the operation of a recessive lethal in explanation of deficiencies in certain recessive groups.

The origin of the races of rabbits in the light of their genetics [trans. title], H. NACHTSHEIM (*Ztschr. Tierzücht. u. Zuchtungsbiol.*, 14 (1929), No. 1, pp. 53-109, pls. 3, figs. 10).—An account is given of the mode of inheritance of the various characters which have been identified in the rabbit. A wide variety of patterns and types have been synthesized through combination of about 20 known factors.

On the nature of hereditary size limitation.—II, The growth of parts in relation to the whole, R. C. ROEB (*Brit. Jour. Expt. Biol.*, 6 (1929), No. 4, pp. 311-324, figs. 8).—In continuing the study of size inheritance (*E. S. R.*, 62,

p. 216), data are presented to show the growth and relation between the size of various organs in the rabbit and rat.

It was found that the relative weights of the pituitary, thyroid, thymus, and adrenals in the rabbit and the eyeballs, liver, pancreas, hypophysis, thyroid, adrenals, submaxillary glands, kidney, and fresh skeleton in the rat could be expressed by the equation $y = ax^b + c$. The data indicate that the ultimate proportions of body parts were not the same in large and small races of rabbits, but the corresponding tissues tended to show an identical relation to total body mass within the same weight range. This is taken to indicate that in a growing organism the size of any part tends to be a specific function of the total body mass or some portion related to it. Such an association is explained as resulting from an equilibrium between the tissues as related to the distribution of nutrient growth essentials. The equation for growth relations of different parts may express eight types of relationships on account of the inactivity of one or more of the constants.

The inheritance of thyroid size and the establishment of thyroid races in ring doves, O. RIDDLE (*Amer. Nat.*, 63 (1929), No. 688, pp. 385-409, figs. 2).—A more complete account of studies noted (E. S. R., 62, p. 216), in which it was pointed out that strains exhibiting characteristically large and small thyroids had been established.

Inheritance of mating ability in breeding boars [trans. title], H. FUNKQUIST (*Hereditas*, 13 (1929), No. 1, pp. 107-120, fig. 1).—The author describes a condition in boars in which they were unable to breed on account of inability to erect the penis. In other respects the sex organs were normal. This condition was inherited as a recessive sex-linked character. There were 12 impotent boars of this type among 23 boars produced by sows giving birth to boars unable to breed.

A herediscope demonstration of dairy cattle improvement, R. R. GRAVES (*Jour. Heredity*, 20 (1929), No. 9, pp. 431-440, figs. 6).—Based on milk and fat production records of sires and dams and their daughters, as noted in U. S. D. A. Technical Bulletin 116 (E. S. R., 61, p. 669), the author suggests the method of inheritance of milk and fat production as demonstrated by the herediscope, a mechanical contrivance designed to explain the transfer of genetic factors from parent to offspring.

The inheritance of polymastia in cattle [trans. title], O. A. IVANOVA (*Ztschr. Tierzucht. u. Zuchtungsbiol.*, 12 (1928), No. 1, pp. 119-135, figs. 10).—From a study of 1,385 cows 3 general forms of polymastia were differentiated. In one form the supernumerary teats were posterior to and separated from the normal teats, in the second form they were fused with the normal teats, and in the third form the rudimentary teats were placed between the normal teats. The study is concerned with the first form.

The size of the supernumerary teats was designated by fractions from 1 to $\frac{10}{13}$ of the normal size. Rudimentary teats were present on both sides in about 50 per cent of the animals, and only on one side in the others which showed polymastia. The cases of nonsymmetrical distribution were equally distributed between the right and left sides. The bulls on which records were available were divided into two classes, i. e., those which produced offspring with extra teats only when mated with cows having extra teats and those which produced offspring with extra teats when mated to normal cows. From a tabulation of the mammary characteristics of the offspring it was concluded that the tendency to produce extra teats of the type studied was dominant and not sex-linked. A study of the milk production of the cows with extra teats indicated that the gene for polymastia was linked with

a gene for milk production which increased the yield about 15 per cent. Cows with only one extra teat did not differ in their milk-producing capacity from cows with two extra teats.

The inheritance of the double loin character in cattle [trans. title], C. WRIEDT (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 51 (1929), No. 3, pp. 482-486, fig. 1).—The occurrence of a heavy-muscled characteristic over most of the body and particularly the posterior parts in cattle is described, which appears to be controlled by a single Mendelian factor. Such calves appear to be less vigorous than normals and are quite subject to such diseases as rickets.

The occurrence of a heritable twisted nose in the house mouse, *Mus musculus*, C. E. KEELER (*Natl. Acad. Sci. Proc.*, 15 (1929), No. 11, pp. 838, 839, figs. 2).—A shortening of one or both nasal bones occurring in three generations of mice is noted. The mode of inheritance was not determined.

Hereditary factors for nasal forms in man [trans. title], K. HILDÉN (*Hereditas*, 13 (1929), No. 1, pp. 87-106, figs. 2; *Eng. abs.*, pp. 104, 105).—From a study of the breadth and height of the noses of inhabitants of the island of Runö in the Gulf of Riga, the author concluded that the heredity of the breadth and height of the nose was controlled by multiple factors and that nose breadth was independent of nose height.

Hereditary differences in the ability of men to produce antitoxin [trans. title], E. ROSLING (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 52 (1929), No. 1, pp. 88-113, fig. 1).—From a study of the relation of the Schick reaction of parents to the Schick reaction of their children in 97 Copenhagen families, it is concluded that the capacity to build up diphtheria antitoxin is controlled by a single Mendelian factor.

On the amount of external mirror imagery in double monsters and identical twins, C. E. KEELER (*Natl. Acad. Sci. Proc.*, 15 (1929), No. 11, pp. 839-842).—A study of 14 pairs of identical twins showed that 78 per cent of the external characters exhibiting asymmetrical patterns were identical, while the other 22 per cent were mirror patterns. In 6 double monsters joined at the side 77 per cent of the asymmetrical patterns were mirrored and 23 per cent were identical. Three ventrally joined double monsters showed 13 per cent mirror patterns and 87 per cent identical patterns. The characters studied were the hands, teeth, hair whorls, and ears.

The question of tumor production in generic hybrids of the tooth carp *Xiphophorus* and *Platyopocilus* [trans. title], C. KOSSWIG (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 52 (1929), No. 1, pp. 114-120, figs. 4).—The author describes the occurrence of melanotic tumors in these hybrids which appear to be associated with the sex hormones.

Studies in sexual phenomena.—VII, The transference of male secondary sexual display characters to the female, J. M. WINTERBOTTOM (*Jour. Genetics*, 21 (1929), No. 3, pp. 367-387).—This is essentially a review of the sex variations in different species of mammals, birds, and insects, showing particularly how the secondary sex characteristics are exhibited in opposite ways in different species within similar groups. A discussion of the physiology of sex characters based on recent investigations, including the hypotheses of several investigators, is included.

On the prevention of castration effects in mammals by testis extract injection, C. R. MOORE and T. F. GALLAGHER (*Amer. Jour. Physiol.*, 89 (1929), No. 2, pp. 383-394).—The authors describe four tests which have been developed and serve as relatively reliable indicators of the sex hormone potency of testicular extracts injected into castrated rats and guinea pigs. These involve the

spermatozoa motility test in the guinea pig previously noted (E. S. R., 59, p. 129), the electric ejaculation test in the guinea pig in which the amount and normalcy of the combined secretions of the seminal vesicles and prostate may be compared, and the prostate and seminal vesicle tests in the rat in which the histological structure of these glands in the normal and castrated individuals differ in a clear-cut manner. Injections of fractions of a lipid extract of bull testes have not only prevented the development of castration effects when injected immediately after castration, but they have restored individuals castrated for several months to practically normal conditions except for the production of spermatozoa.

Studies on the physiology of reproduction in birds, XXIV-XXVI (*Amer. Jour. Physiol.*, 86 (1928), No. 2, pp. 266-273, fig. 1; 87 (1928), No. 1, pp. 97-123, figs. 2).—Three articles continuing this series (E. S. R., 62, p. 515) are noted.

XXIV. *On the extirpation of the bursa Fabricii in young doves*, O. Riddle and M. Tange (pp. 266-273).—The complete removal of the bursa Fabricii in 66 ring doves at an early age, of which 31 reached maturity, had no effect on growth rate, adult weight, or the age of sexual maturity. It is assumed that the presence of the thymus offsets any deficiencies in the endocrine secretions resulting from the removal of the bursa. An unexpected number of right ovaries and right oviducts was observed in the operated birds. The ureters were frequently injured by the operation, resulting in the complete disappearance of one kidney in each of two birds.

XXV. *The action of the ovarian and placental hormone in the pigeon*, O. Riddle and M. Tange (pp. 97-109).—Injection of ovarian and placental hormone into immature doves did not hasten the attainment of sexual maturity, but the injections stopped the growth of ovaries and testes, though in a few cases hyperplasia and hyperemia of the oviduct were noted. The hormone seems favorable for growth in the accessory female genital organs only and is adverse to growth in the accessory male genital organs and to growth in the primary germ glands of both sexes.

XXVI. *The rôle of the anterior pituitary in hastening sexual maturity in ring doves*, O. Riddle and F. Flemion (pp. 110-123).—Studies of the influence of transplantation of 509 dove pituitaries and of injections of glycerin, acid, and alcohol extracts of bovine glands on the development and growth of various organs of immature doves are reported. Daily homeotransplants and intra-peritoneal injections of glycerin extract of fresh bovine anterior lobes increased growth in the testes and in some ovaries of immature birds. Acid and alcohol extracts had no effect. The anterior pituitary hormone also accelerated the attainment of sexual maturity.

A comparison of anterior hypophyseal implants from normal and gonadectomized animals with reference to their capacity to stimulate the immature ovary, H. M. EVANS and M. E. SIMPSON (*Amer. Jour. Physiol.*, 89 (1929), No. 2, pp. 371-374, fig. 1).—The influence of implantation of the anterior hypophyses from normal and spayed females and from normal, cryptorchid, and castrated adult males on the development of the ovaries of immature females was studied with rats at the California Experiment Station.

The hypophyses were removed from the adults 2 months after the operation, and 2 glands were implanted in 24-day-old females on each of 2 successive days. The immature females were tested daily for oestrus, and 4 days after the implantation the weights of the 2 ovaries were determined. None of the control immature females showed oestrous vaginal smears on the fourth day, but 16 per cent of those implanted with hypophyses from normal females showed oestrus and all those implanted with glands from gonadectomized

males and females, cryptorchid males, and normal males showed oestrous smears on the fourth day. The combined weights of both ovaries averaged in normal immature females 17 mg. and in immature females implanted with hypophyses from normal females 19.5 mg., but the average weights of the ovaries of the immature females were increased by implantation with hypophyses from the other sources to the following weights: Normal males 69.5 mg., gonadectomized females 113.5 mg., cryptorchid males 129 mg., and gonadectomized males 176 mg. It appeared to be the germ cell component of the testis rather than the interstitial tissue that is related to the stimulus of the hypophysis. It also appeared that following gonadectomy or destruction of the germ cells the hormone gradually accumulates in the hypophyses until atrophy occurs.

A sex difference in the hormone content of the anterior hypophysis of the rat, H. M. EVANS and M. E. SIMPSON (*Amer. Jour. Physiol.*, 89 (1929), No. 2, pp. 375-378).—Studies similar to the above indicate that the hypophyses from normal males are about 3.5 times as potent sources of the sex hormone as hypophyses from normal females. It also appeared that after gonadectomy both sexes produce the hormone at an equal rate. This conclusion is based on the difference in the relative amounts present prior to gonadectomy.

Transplantation of ovaries in the guinea pig for reproduction and for the endocrine effect during pregnancy, E. H. HERRICK (*Kans. Acad. Sci. Trans.*, 31 (1922-1928), pp. 51, 52).—Two successful cases in the production of offspring are reported from the transplantation of the ovaries from a recessive guinea pig into a dominant individual. When one female was mated to a recessive male a recessive individual was produced. In the other case the dominant color pattern appeared in the offspring, indicating that the female gamete was produced by some original ovarian tissue which was not removed by the operation.

The results of studies of the influence of ovariectomy on pregnant guinea pigs are also reported, as previously noted (*E. S. R.*, 60, p. 633).

The effect of pregnancy on the anterior hypophysis of the rat and cow as judged by the capacity of implants to produce precocious maturity, H. M. EVANS and M. E. SIMPSON (*Amer. Jour. Physiol.*, 89 (1929), No. 2, pp. 379, 380).—In studies at the California Experiment Station, it was found that three daily doses of approximately 35 mg. of anterior hypophyseal tissue from the cow, when implanted in the 24-day-old female rats, would provoke oestrus on the fourth day. A similar amount of hypophyseal tissue from a pregnant cow was required to give the same result. There was little increase in the sex hormone content of anterior hypophyses of pregnant rats as contrasted with nonpregnant females and of multipara as contrasted with virgin females.

A comparison of the ovarian changes produced in immature animals by implants of hypophyseal tissue and hormone from the urine of pregnant women, H. M. EVANS and M. E. SIMPSON (*Amer. Jour. Physiol.*, 89 (1929), No. 2, pp. 381-387).—Studies of the relative changes in the weights of the ovaries of immature rats resulting from variations in the dose of follicular extract and in the amount of anterior lobe implanted showed, at the California Experiment Station, that in case of the follicular extract increases in the dosage over the minimum by 32-, 50-, or even 160-fold barely doubled or trebled the weight of the ovaries, while on the fourth day the weights of the ovaries of immature females implanted with anterior hypophyseal lobe were proportional to the amount of material implanted. When a heavy dose (1 cc.) of the extract was administered daily for 10 days the weight of the ovaries (117 gm.) on the tenth day was comparable to the weight of the ovaries obtained by the

implantation method. The increased weight of the ovaries was found to be due to increased follicular development and increased numbers of corpora lutea. Histological studies showed that either method of stimulation may provoke true ovulation, although the corpora lutea more frequently inclosed the ova.

Does regeneration follow complete ovariectomy in the albino rat? F. M. HEYS (*Science*, 70 (1929), No. 1812, pp. 289, 290).—In continuing studies by Hanson and Heys, previously noted (*E. S. R.*, 59, p. 220), 108 rats ranging in age from 10 to 40 days were spayed without evidence of regenerated ovarian tissue. Among a number of mature rats, newly formed ovarian tissue was found in three. It is concluded that the regeneration of ovarian tissue does not occur in case of complete removal of the ovaries. The irregularity of the ovaries of mature females and their embedment in fat make complete removal difficult.

How large is the mammalian egg? C. G. HARTMAN (*Quart. Rev. Biol.*, 4 (1929), No. 3, pp. 373-388).—The dimensions of the ova of various mammals as reported from different sources are presented and summarized in tables. It is pointed out that for accuracy of measurement living eggs are more reliable than fixed tissue. The vitellus or ovum proper is mainly considered in the measurements. The author has tabulated the range in normal egg size of 25 species of mammals as he understands them.

Investigations of chicks: The development of the embryo during the first two days of incubation [trans. title], R. WETZEL (*Ztschr. Wiss. Biol., Abt. D, Arch. Entwickl. Mech. Organ.*, 119 (1929), pp. 188-321, figs. 127).—A detailed study of the early embryology of the chick.

Changes in pH of albumen and yolk in the course of embryonic development under natural and artificial incubation, A. L. and A. J. ROMANOFF (*Biol. Bul. Mar. Biol. Lab., Woods Hole*, 57 (1929), No. 5, pp. 300-306, figs. 3).—In a study of the hydrogen-ion changes in the albumin and yolk of hen's eggs during incubation at Cornell University, the pH of the fresh albumin and yolk was found to be, respectively, 7.827 ± 0.046 and 5.973 ± 0.015 . The outer layer of albumin was slightly more alkaline than the inner layer. The alkalinity of the albumin increased during the first few days of incubation, reaching a high point at about two days. After this there was an increase in acidity, reaching the pH of the fresh egg at about the sixth day of incubation and continuing to become more acid as the incubation period progressed. The pH of the yolk increased with incubation up to the sixteenth day, at which time there appeared to be a sudden temporary decrease. The changes in the pH of the albumin and yolk were similar under conditions of natural and artificial incubation.

The fluctuation in the monthly ratio of boys per 1,000 births [trans. title], J. ANKER (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 52 (1929), No. 1, pp. 61-87).—Variations in the duration of the gestation period in man are discussed, and it is pointed out that boys have a shorter gestation than girls. The relation of sex ratio to abortions and stillbirths is discussed. It was found that there was no correlation between the sex ratio and the number of children born in the same month, but the correlations in German and Danish data between these variables in successive months were 0.202 ± 0.105 and 0.353 ± 0.103 .

FIELD CROPS

Handbook of breeding of agricultural plants, C. FREUWIRTH (*Handbuch der Landwirtschaftlichen Pflanzenzüchtung*. Berlin: Paul Parey, 1930, vol. 1, 7. ed., rev., pp. XX+478, pls. 8, figs. 107).—This is a revised edition of volume I of the

handbook noted earlier (E. S. R., 47, p. 823) covering General Principles for the Breeding of Agricultural Plants.

[Field crops work in Arkansas], M. NELSON, J. O. WARE, C. K. MCCLELLAND, G. JANSSEN, W. H. MITZGER, E. C. TULLIS, J. R. COOPER, and V. M. WATTS (*Arkansas Sta. Bul.* 246 (1929), pp. 11-17, 19-21, 23-26, 27, 29, 30, 31, 33, 34, 35-37, 59, 60, 61, figs. 2).—Agronomic research (E. S. R., 60, p. 812) reported on from the station and substations embraced variety tests with cotton, corn, wheat, oats, soybeans, cowpeas, peanuts, potatoes, sweetpotatoes, and miscellaneous legumes; fertilizer experiments with cotton, rice, potatoes, and sweetpotatoes, and with corn, oats, wheat, and clover in rotation; cultural (including planting) tests with cotton, corn, soybeans, peanuts, and miscellaneous legumes alone and interplanted with other crops; seed treatment with seed corn; and breeding work with corn, cotton, and oats.

Fertilizer experiments with cotton variously made at the Cotton Substation and at Scott and cooperatively in different parts of the State were concerned with the response to nitrogen and phosphorus, alone and in combination, on different soils in the hill, coastal plain, and lowland sections of the State; different rates of application and varying analyses of complete fertilizer; home-mixed v. factory-mixed fertilizers; placement of fertilizers: the comparative values of nitrogen carriers; the ratio of organic:inorganic nitrogen in the fertilizer; and the response of fruiting characters of cotton to nitrogen, phosphorus, and potassium in varying acre rates.

The several new strains of Rowden, Acala, and Express developed by the station were outstanding for a maximum number of qualities desirable in a variety. Lightning Express, Express 121, the D. & P. L. strains, Coker Cleveland, Wilson Type Big Boll, Dixie Triumph, Trice 730, and some of the Delfos strains showed good productivity. The principal conclusions from spacing tests have been recorded (E. S. R., 60, p. 816). In continued selection of cotton for high and low oil and high and low protein in the seed, the current average of the high-protein group was 26.85 per cent of protein and the low-protein group 23.16 per cent. The high-oil group averaged 26.69 per cent of oil and the low-oil group 21.89 per cent. With the same plants where the protein was high the oil was low, and vice versa. In the high-protein group the oil percentage was 23.3, and in the low-protein group 26.88. In the high-oil group the protein percentage was 22.42 and in the low-oil group 24.8.

Widening corn rows reduced yields, and growth of interplanted cowpeas, soybeans, velvetbeans, and mung beans in the same row at corn planting was only medium. Planting one and two hills of legumes between hills of corn resulted in respective average reductions of 8.2 and 10 bu. per acre, velvetbeans causing the greatest reduction and mung beans the least. With legumes planted as the corn was laid by, only slight reductions or gains were obtained. The soil improvement value of these legumes for succeeding crops was recorded at Scott and the Cotton Substation. In sand culture the order of tolerance of low to high acidity was red clover, vetch, serradella, California bur clover, spotted bur clover, and velvetbean. The best growth of most legumes grown was obtained at a soil reaction of pH 6 to 6.8. The order of acid tolerance on soil ranging from high to low acidity was serradella, subterranean clover, vetch, bur clover, Austrian field pea, soybean, Canadian field pea, crimson clover, Hubam clover, and biennial white sweetclover.

Alfalfa grown on soil containing 12 and 22 per cent moisture was cut at (13 times) succulent, (10) blossom, and (6) seed pod stages during two years. The largest dry weight of tops was produced by alfalfa cut in the blossom stage, irrespective of whether the plants were grown on soil low or high in moisture. Plants in soil containing 22 per cent of moisture yielded twice as

much, based on dry weight of tops cut in the blossom stage, as plants grown on dry soil. The weight of roots of plants on either wet or dry soil increased directly with the infrequency of cuttings, and the rate of plant recovery after cutting, and consequently the rate of growth, had similar relations. No definite relationship could be noted between the percentage of carbohydrate in roots of plants given different cutting treatments. The greatest amount of carbohydrates in the roots was found in roots of plants the tops of which were cut less often.

Both variety and locality seemed to affect the amount of suckering of corn at the station and at Scott. May 1 to 15 plantings bore the greatest number of suckers. Neither size of seed nor content of moisture or available nitrogen in the soil appeared to affect the rate. Deep planting caused an increase, and more stalks per hill, especially in hills 11 in. apart, caused reductions. Removal of suckers, especially when of some size, reduced the corn yield.

Sorgo plants in the process of crushing for sirup manufacture were cut without stripping leaves at time of crushing, cut with stripping leaves at time of crushing, or stripped, cut, and left in piles before crushing. The largest average quantity of juice was extracted from plants stripped October 1 and cut at the time of crushing, the least juice was obtained from sorgo not stripped when crushed, and there was an inverse relationship between the percentage of juice obtained and its sugar content from the different plant treatments. It is suggested that the high sugar content in juice of stalks cut and piled may be due to evaporation, thereby making the sap more concentrated, or to hydrolysis of dextrins to sugars. The middle internodes contained a higher percentage of juice and sugar than either the top or basal internodes. According to tissue analyses, the percentage of sugars varied little between basal and middle internodes, whereas the top internodes contained much less sugar than either the base or the middle portion of the plant.

The passing of sorgo through rollers set very closely extracted considerably more juice than when the rollers were loose or even set at medium tightness, and the percentage of sugar was increased from 2 to 4 per cent by the first method. When the same sample of sorgo was subjected to loose, medium, and heavy pressure, loose crushing extracted as much sugar on percentage basis as the other pressures and never varied more than 1 per cent from the medium and heavy crushings. By repeated crushings over 17 per cent more juice in one sample and 6 per cent more in another was removed than from the same sample subjected to a single crushing.

Considering the effect of fertilizers on sterility of rice, fair to good production was made by plants treated with green manure and with ammonium sulfate, and by plants untreated and not flooded. However, when flooded continuously ammonium sulfate treatments resulted in practically no seed, and green manure, while fair, produced much better when flooded a week before heading or only after 50 days. Aeration of the soil, either by draining for a week previous to heading of the rice plant or leaving off water for 50 days or until the plant reached the boot stage, proved beneficial. It appeared that straighthead is brought about by the accumulation of an incompletely oxidized compound in the flooded soil. While nitrogen relationships may or may not play a part, they are not believed primarily responsible for development of straighthead.

Cotton in the Panhandle of Oklahoma, H. H. FINNELL ([Oklahoma] Panhandle Sta., Panhandle Bul. 14 (1930), pp. 8-13).—Cotton experiments at Goodwell at an elevation of 3,300 ft., with rainfall 178 in. annually, a frost-free period approximating 180 days, and a growing season for cotton of about 150 days indicated that production possibilities on silty clay loam soil are too

low to warrant consideration of cotton in competition with wheat and grain sorghums. Acala, Trice, and Oklahoma 44 followed closely by Lightning Express and Half-and-Half seemed to be the better adapted varieties. Close spacing in the row was strongly indicated.

Cotton variety tests, 1929. W. B. ROGERS and E. E. HALL (*South Carolina Sta. Circ. 40* (1930), pp. 11).—Varieties and strains of cotton producing the highest average yields of seed cotton at the station during the period 1924–1929 included Cook 1010, King, Trice, Coker Cleveland 5, and Piedmont Cleveland. Cook 1010 and King have not produced staple satisfactory in length. During the same period at the Coast Substation Coker Cleveland 5 led and was followed by Wannamaker Cleveland and Woolsey Cleveland, both yielding about the same. At the Sandhills Substation in 1928 and 1929 King, Rhyne Cook, Coker Cleveland 5, Wannamaker Dixie Triumph, and Watson Dixie Triumph made the most seed cotton. Dixie Triumph, Coker Cleveland 5, Woolsey Cleveland, and Humco-Cleveland 20 averaged highest in production in tests at the Pee Dee Substation during 1925, 1926, 1927, and 1929. The best strains of Cleveland led in production of seed cotton and are recommended for general planting on wilt-free land.

Physical and chemical characteristics of hemp stalks and of seed flax straw. E. R. SCHAFER and F. A. SIMMONDS (*Indus. and Engin. Chem.*, 21 (1929), No. 12, pp. 1241–1244, figs. 3).—Hemp grown in Wisconsin for textile fiber was separated at the U. S. D. A. Forest Products Laboratory into its principal physical components, bast fiber and hurds. Chemical examination of components and the entire stalk and comparison with data on seed flax straw previously analyzed showed hemp to be practically identical with seed flax in both physical and chemical properties. In discussion of the possibility of growing hemp for paper manufacture on peat marsh land that has little value for the production of other crops, it is estimated that fiber may be produced for 7 cts. per pound, provided a market exists for at least 1,000 tons annually.

Tests with potato seed from various sources. R. A. JEHLE and E. I. OSWALD (*Maryland Sta. Bul. 317* (1929), pp. 230–255, figs. 2).—In comparative trials of Irish Cobbler potato seed during 5 years in Worcester County, Maryland, the largest average acre yield, 265.2 bu., was obtained from northern-grown certified seed; second, 220.4 bu., from mountain-grown certified seed; third, 209.3 bu., from fall-grown certified seed; and the lowest, 186.1 bu., from uncertified seed. The differences in yield obtained from seed secured from different growers in the same locality were as large as or even larger than the average yield differences obtained from the seed procured from different localities, indicating that the character of the individual seed stock has a greater influence on yield than the locality where grown. The average yield from certified seed exceeded that from uncertified seed. The smallest yields were made in plats with the most missing, weak, and diseased plants. It appeared that seed which comes up and matures earliest usually yields best, although this may be offset by other factors. The most significant conclusion drawn from the tests was that health and vigor of the seed stock is the prime factor influencing its productivity.

Impregnation of potatoes with fertilizer. W. F. GERICK (*Amer. Jour. Bot.*, 16 (1929), No. 10, pp. 859, 860).—Potato sets charged with capsules of fertilizer were compared at Stockton, Calif., by the University of California with untreated sets. Depending on the nature of the treatment employed, the treated seed suffered a varyingly greater mortality than the untreated. Early in the growing season all plants from treated seed were weaker than from

untreated, but the differences disappeared as the season advanced. Correction for stand resulted in an increase of yield from 10 per cent to 40 per cent for all treated plats over untreated ones. The fertilizer required to plant a unit area of land by the method was a very small fraction of that used by the usual method of fertilization, and the method may have special application where the soil has high fixing power for certain fertilizers.

Protein content of reed canary grass on peat soils, F. J. ALWAY and G. H. NESOM (*Jour. Agr. Research* [U. S.], 40 (1930), No. 4, pp. 297-320, figs. 3).—More than 150 samples of reed canary grass (E. S. R., 61, p. 331) grown on peat soil in Minnesota from American, German, and Russian seed were analyzed for content of protein. Previously determinations in Europe and the United States showed a range of 3.44 to 22 per cent in moisture-free grass.

The protein percentage found in the entire grass, on a moisture-free basis, ranged from 6.6 to 25.2, in the culms from 2.8 to 11.9, in the leaves from 8.5 to 23.5, and in the panicles from 9.4 to 30.5. The maximum found in the culms exceeded the minimum in the leaves, but in every sample there was a much higher percentage in the leaves than in the culms. Leaves formed from 31 to 72 per cent of the dry matter in the first cutting and from 65 to 85 per cent in the aftermath. As maturity advanced in the first growth up to blooming, the proportion of the total dry matter formed by the leaves fell rapidly without a corresponding decline in their protein content.

The panicles made up less than 12 per cent of the dry weight of the first growth and were absent from the aftermath, yet their protein content was usually higher than in the leaves and varied independently of the latter. The blade formed from 53 to 81 per cent of the dry matter of the leaf and its protein content varied from 15.5 to 26.87 per cent, while that of the sheath varied from 6 to 13.2 per cent. The quantity in the sheath was only from one-third to one-half as high as that in the blade, and the two values rose and fell together.

Higher protein content was favored by early mowing, thin stands, and an increased supply of available nitrogen. In the aftermath the protein varied less and in general was much higher than in the first growth. Differences in the protein content of grasses of various strains, sown at the same time and harvested at the same stage of maturity, were at most very small compared with differences connected with degree of maturity and nitrogen supply.

Broadcast seedings yielded much less hay and protein than row seedings under like conditions, with weeds and other grasses kept down until reed canary grass became established. The yield and protein content of hay from this grass appeared to be unusually sensitive to the supply of available nitrogen in the soil, and the protein content to be influenced very much by the stage of maturity and consequent proportion of culm and sheath.

Sisal [trans. title] (*Rev. Internat. Prod. Colon.*, 5 (1930), No. 49, pp. 1-35, pls. 2).—This number contains a number of short articles on the production of sisal in the French colonies, Belgian Congo, Mexico, and in the British Empire.

Tobacco Substation at Windsor, report for 1929, P. J. ANDERSON, T. R. SWANBACK, O. E. STREET, ET AL. (*Connecticut State Sta. Bul.* 311 (1930), pp. 197-273, figs. 21).—The tobacco experiments (E. S. R., 61, p. 134) reviewed for 1929 were carried on in a season marked by exceptionally low rainfall during the growing period and by the most destructive hailstorm in the history of the Connecticut Valley. Both the amount of rainfall and its distribution were unfavorable to production of a good crop of tobacco. The most noticeable effects of the dry season on the quality were more prominent veins and heavier leaves. The total tobacco loss due to hail exceeded \$2,359,000 on the 715

farms furnishing complete information to the State Commissioner of Agriculture, \$319,000 being shade-grown tobacco, \$1,750,000 Broadleaf, and \$218,000 Havana Seed.

Potash fertilizer experiments (pp. 207-215).—The fire-holding capacity of tobacco grown on plats receiving no potash was found to grow less every year, whereas on plats receiving 100 and 200 lbs. per acre this quality was not impaired during the first 2 years. Raising the application to 300 lbs. did not affect the burn or benefit the yield or quality of the crop.

The percentage of potash in the leaf appeared to be affected materially by the quantity applied in the fertilizer, even though the soil contained an enormous natural reserve of potash. The deficiency of potash in the leaf from the plats receiving no potash became more pronounced during the second year than in the first. Less potash was deposited in the leaves when 100 lbs. of potash per acre was applied in the fertilizer than with 200 lbs., but the deficiency in the second year was not greater than in the first. Decrease in potash was accompanied by increase in both calcium and magnesium in the leaf. A general relation was observed between fire-holding capacity, as measured by the strip test, and the ratio of potash to calcium and magnesium, i. e., the wider the ratio in favor of potash the longer was the burn.

Differences in fire-holding capacity, as measured by strip tests, resulting from the use of the sulfate, carbonate, or nitrate of potassium, or tobacco stems or various combinations thereof were very small. There was no indication that tobacco would actually take up more potash from one carrier than from another. The quantity of organic sulfur was remarkably constant, about 0.13 per cent of the dry weight of the leaf, and did not vary with the source of fertilizer potash, whereas sulfate sulfur varied considerably, depending upon the quantity applied in the fertilizer. Considering growth, addition of sulfur in the fertilizer mixture seemed unnecessary. Application of sulfates to the soil increased the percentage of sulfates which appeared in the leaves, where they harm the burn. During five years indications were that when the sulfate, carbonate, nitrate of potassium or various combinations thereof supply 200 lbs. of potash per acre, none will change significantly the reaction of the soil of the test type.

The use of manure as a supplement to commercial fertilizer (pp. 216-219).—The moderate use of manure to supplement commercial fertilizer is deemed a good practice wherever manure is available on the farms. Manure applied annually invariably made the soil less acid, and the effect obviously was permanent. Such change in reaction might at least partly account for the greater prevalence of black root rot in fields which have been heavily manured. Impaired burn did not result from the use of manure.

Hyper Humus, T. R. Swanback (pp. 220-227).—Addition of Hyper Humus, a black and granular processed swamp peat residue, has, up to a certain extent, benefited growth of tobacco in the greenhouse on sand practically free from organic matter, while in the field, where the treatments merely supplemented the organic matter already present, results only slightly favored the material. H. G. M. Jacobson found from soil samples taken six months after treatment that, up to 60 tons per acre, organic matter increased steadily, whereas further applications did not increase the content correspondingly. In general, addition of Hyper Humus caused little improvement in yield and no change in soil reaction.

Chemical composition of a poor burning tobacco crop compared with a good burning crop, E. M. Bailey and P. J. Anderson (pp. 228-233).—Analyses of tobacco from the poor burning crop of 1924, an extremely dry season, and from the good burning crop of 1927, a season of high rainfall, revealed that chlorine,

calcium, magnesium, nitrogen, phosphorus, sulfur, and manganese were the higher in the 1924 crop, whereas potash, silica, iron, and alumina were lower. The alkalinity of the good burning 1927 crop was uniformly much higher than that of the poor burning crop of 1924, and in the seconds, usually the best burning leaves, the alkalinity in every case exceeded that in the darks from the same plat.

Chemical investigations of tobacco, H. B. Vickery and G. W. Pucher (pp. 234-246).—Chemical studies in cooperation with the Carnegie Institution of Washington dealt with the bases of tobacco extracts, including nicotine and alkaloids other than nicotine. It was concluded that mature tobacco seed contains only undetectable traces of nicotine. Nicotine was found in the sprouts and cotyledons of tobacco seed after only 9 to 11 days of germination. It was also evident that nicotine could be synthesized at a very early stage in growth by the plant from the reserve of food material in the seed. Outside sources of nitrogen did not appear to be called upon at this stage for synthesis. The nitrogen distribution in germinated and ungerminated seed is also reported.

Determinations on green tobacco grown in the hothouse under different fertility conditions demonstrated that the nitrate nitrogen may vary from 0 to 23 per cent of the total nitrogen or from 0 to 50 per cent of the total soluble nitrogen of the plant. Data on cured tobacco showed that the proportions of nitrate nitrogen may also vary widely in tobacco plants grown under field conditions. Conclusions were that the nitrate nitrogen in tobacco may vary over a wide range, depending upon the rainfall during growth, as well as upon the type of nitrogen fertilization.

Field experiments on brown root rot, H. F. Murwin, G. P. Clinton, and P. J. Anderson (pp. 247-255).—Field experiments at Poquonock in cooperation with the U. S. Department of Agriculture had to do with the effects of preceding crops and of other cultural practices upon the development of and upon the prevention of brown root rot.

The type of brown root rot present was closely associated with the previous cropping system, becoming most severe when tobacco followed timothy, corn, rye, alfalfa, or clover, whereas potatoes were less injurious. With continuous tobacco or fallowing without fertilization injury was reduced to a very low degree, yet leaving the natural weed growth on the land for a year was more beneficial than either practice. Stable manure increased the yield, and annual applications of lime were beneficial. Acid fertilizer reduced the disease on the roots, but did not help yield because the soil became too acid for good growth. It was found that the disease could be eliminated completely by steaming or thoroughly aerating the soil. Recommendations are based on these and other experiments.

Black root rot resistant shade tobacco, J. G. Wolf (pp. 256-263).—A strain of Cuban shade tobacco (4R) highly resistant to root rot but similar in other respects to ordinary shade tobacco, isolated and tested for 2 years, was fairly uniform and apparently a mutant and not a hybrid. Its field behavior is described.

Seasonal fluctuations in soil reaction, T. R. Swanback and M. F. Morgan (pp. 264-268).—Observations during three seasons on periodic variation in the soil reaction of certain nitrogen carrier plats at Windsor and in concrete walled soil plats variously fertilized at New Haven showed that during late spring and early summer, particularly after nitrogen fertilization, there is a marked increase in soil acidity (decrease in pH). A dry season evidently produces a more acid condition than a wet season. Withdrawal of nitrate nitrogen by

the crop and the leaching of the fertilizer from the soil by heavy rains seemed to restore the pH to a normal condition in the autumn. During winter decreases or increases occur in acidity, which may be due to mild periods when the frost leaves the ground or to the accumulation of acids added by rain or snow and unable to escape from the frozen soil. A return to normal conditions could be expected in the early spring.

Damping off of young seedlings (pp. 269, 270).—Damping off of young tobacco seedlings occurring in unsterilized plant beds in the greenhouse, evidently due to Pythium, was prevented by saturating the soil with a 1 per cent solution of acetic acid and seeding about three weeks later.

Raising tobacco by tractor (pp. 271-273).—The crop of 1929 was grown with all the operations of tobacco growing performed by tractor. Plowing and harrowing in the open fields presented no problems because these were already common practices with many growers, whereas the shade fields required certain modifications. The two-bottom plow adopted as suitable for turning the furrow close to and between the poles had a very wide adjustable offset. Certain minor changes facilitated drilling fertilizer, setting plants, and drawing tobacco racks. Cultivating was done with a two-row cultivator. It was found possible to eliminate packing the soil entirely by the use of open-face wheels. No great mechanical difficulties appeared to be in the way of substituting tractors for horses entirely in growing tobacco.

Cel-O-Glass seed bed sash (p. 273).—Plants in beds under Cel-O-Glass, a glass substitute made of fine mesh wire screen imbedded in a translucent material and light and rather flexible, did not grow as rapidly as under ordinary glass, and required about 10 days longer to attain a size suitable for setting. Otherwise no differences were observed.

Bibliography of "germination of seed," W. J. FRANCK ET AL. (Wageningen: Internat. Seed Testing Assoc., Com. Pub. and Registr., 1928, pp. [1]+XXVIII+214).—This multigraphed publication prepared for members of the International Seed Testing Association comprises references grouped as to influence of physical factors, of chemical factors, and of living factors on germination, relation of seed development to germination, technic of germination, and miscellaneous publications on germination, and includes tables of contents in English, German, French, Danish, Italian, and Dutch, and lists of authors.

Inspection of agricultural seeds, H. R. KRAYBILL, O. S. ROBERTS, R. O. BITLER, R. B. SCHULTE, E. M. PATT. and P. BALBACH (Indiana Sta. Circ. 169 (1929), pp. 118, fig. 1).—Tables presented show the purity, germination percentage, weed seed content, and for legumes hard seed content for 1,279 official samples of agricultural seed collected from seed dealers in Indiana during the year ended June 30, 1929. The cover page gives brief directions for the prevention of introduction and the eradication of dodder.

HORTICULTURE

[Horticultural investigations at the Arkansas Station] (Arkansas Sta. Bul. 246 (1929), pp. 53-59, 60, 61-63, figs. 5).—This is a progress report continuing earlier work (E. S. R., 60, p. 818).

Slow growth of pollen tubes in selfed apple blooms is considered by J. R. Cooper and C. B. Wiggans to be an important factor in failure to set. Varieties differed also in the rate of pollen tube growth. The relative percentage of primary set of different varieties remained quite constant throughout the season, suggesting no prolonged effect of the differential growth rates of the pollen. The rate of dropping followed the same general curve for all pollens applied to a

single mother tree. Studies of the reproductive organs of the Stayman Wine-sap apple showed both a lack and a defectivity of pollen. Stayman Winesap buds developed normally up to the stage of resting pollen mother cells. It is believed that abortive pollen resulted from abnormal or suppressed division. Varying amounts of abortion occurred in all varieties tested, increasing with malnutrition. The amount of viable pollen varied between anthers and even between locules of the same anther. Ovule development appeared normal in all cases. Abnormalities occurred in all varieties as a result of low temperature or retarded pollination. Delicious and Arkansas seemed most susceptible to cold. Temperatures just above freezing apparently inhibited the fusion of the nuclei and in some cases prevented the development of the fertilized ovules.

Ben Davis and Delicious flower buds usually differentiated slightly in advance of other late varieties. The earliest initiation was observed in Yellow Transparent. Rapid summer and autumn development of fruit buds in Yellow Transparent was offset by slow progress in the spring.

Analyses by Cooper, V. M. Watts, and Wiggans over a 2-year period of fruit buds collected in different parts of the tree at the beginning of differentiation and at 2-week intervals thereafter indicated that increased fruit bud formation is accompanied by a higher carbohydrate-nitrogen ratio. It was observed that the chemical composition of plants was constantly changing, suggesting the need of continuous sampling.

Cutting off half of each leaf on a limb was found by Cooper and Wiggans to reduce the number of fruiting spurs by 11.2 per cent. Defoliation of adjacent spurs reduced fruit setting. Foliage reduction caused a greater abscission of fruit later in the season. Medium pruning for the first time gave better results than did severe or no pruning with fertilizer. It is thought that shade in the case of the unpruned trees had become so dense as to hinder the development of the interior spurs.

No fertilizer treatment gave any outstanding results with grapes over a 5-year period, except that nitrogenous fertilizers and manures seemed to produce an overvegetative condition. Wiggans found that leaf coverings of various kinds, including lampblack and whitewash, induced uneven and delayed ripening in the grape. Lack of pruning also promoted uneven ripening. Summer pruning, except the removal of suckers, retarded ripening in proportion to the amount of leaf surface removed. Shading and irrigation somewhat delayed ripening, while girdling tended to hasten maturity. Where frost injury occurred before the shoots were more than 6 in. in length the removal of injured shoots gave good results, but beyond this growth stage the best procedure was to cut back the fruiting cane one-half in order to induce strong canes for the succeeding year.

Cooper found that superphosphate was the only fertilizer to give significant gains in yield for Klondike and Premier strawberries on Clarksville loam. Straw mulch reduced yields and delayed ripening. On Ruston and Orangeburg loam complete fertilizers were necessary.

Tomato fertilizer experiments conducted by Cooper and Watts showed the importance of phosphorus. Nitrogen gave some gains, but potash had no effect. Applications under the row gave the best results. For cantaloupes a complete fertilizer proved most desirable, with phosphorus, nitrogen, and potassium ranged in descending order. Manure supplements gave large increases in yield.

Staking tomato plants, according to Watts, tended to increase the set of fruit and decrease sun scald and mechanical injury. Yield was reduced in direct proportion to the amount of pruning. Neither pruning nor staking in-

creased earliness. Watts found that lengthening the day by the use of electric lamps increased primary growth of tomato plants. Supplying additional temperature equal to that of the lamps had some benefit but not equal to that of light. In case of plants lacking in nitrogen, increased day length and added heat retarded primary growth, but increased starch, suggesting that an excess of carbohydrates had limited vegetative development. Tomatoes with abundant and with low nitrogen supply were subjected to different light conditions with the following results: (1) Bud production and fruiting were greatest in full light and with high nitrogen, (2) bud production was limited by nitrogen shortage, except where light was also limited, in which case the maximum set of fruit was almost equal, and (3) some correlation was observed in the high nitrogen plants between the starch-total nitrogen ratio and bud production.

[Horticultural investigations at the Kentville, N. S., Experimental Station, 1928], W. S. BLAIR (*Canada Expt. Farms, Kentville (N. S.) Sta. Rpt. Supt. 1928, pp. 13-37, 38-41*).—A general report (E. S. R., 60, p. 540) on varieties, cultural practices, etc.

Averaging 6 years' records, yields of 8,417, 7,794, and 5,577 qt. of Senator Dunlap strawberries were obtained, respectively, per acre from 200, 100, and 0 lbs. of nitrate of soda used as a spring top-dressing.

The transplanting of apple trees 11 years of age gave poor results, only one-eighth of the trees making satisfactory recovery. Apple trees on Doucin roots outgrew those on Paradise.

Comparing three dates of applying fertilizer to fruit trees, greater net returns were obtained June 8 than from April 25 or May 17, but May 17 is conceded to be the more practical date. Of four nitrogenous fertilizers, nitrate of soda gave larger net returns than nitrate of lime, sulfate of ammonia, and cyanamide, when used on apples. Limestone, 2 tons per acre, in 1916, 1919, 1923, and 1926 gave no apparent benefit, except that the legume cover crops were much more vigorous on the limed areas.

Suckering of Early Malcolm and Golden Bantam sweet corns had little or no influence on earliness or yield.

Of three spacings, 1-in. gave larger yields than 2- and 3- in the case of Thomas Laxton, English Wonder, and Stratagem peas.

The results of a staking and pruning experiment with tomatoes are discussed.

Vegetable growing, J. E. KNOTT (*Philadelphia: Lea & Febiger, 1930, pp. XVI+17-352, figs. 62*).—A general text prepared primarily for agricultural students and dealing with the fundamentals of vegetable production.

The artichoke in Limousin, J. BOSVIEUX (*Le Topinambour en Limousin. Thesis, Inst. Agr. Beaurais, 1929, pp. 98*).—A general discussion of the botany, chemical composition, methods of culture, harvesting, and utilization.

Cauliflower and broccoli culture, A. G. B. BOUQUET (*New York: Orange Judd Pub. Co.; London: Kegan Paul, Trench Trubner & Co., 1929, pp. 125, pls. 11*).—General cultural information is presented.

Effect of nitrates on the growth responses of *Mentha piperita* cuttings, E. O. LEONARD and F. B. WANN (*Amer. Jour. Bot., 16 (1929), No. 10, p. 844*).—Studies at the Utah State Agricultural College upon the effect of limiting nitrogen and potassium nutrients upon mint cuttings indicated that nitrogen has a marked influence on growth, with little effect by potassium. In solutions with nitrogen, top growth above the solution usually died, though abundant new shoots and a few short roots were produced by submerged portions. Without nitrogen top growth remained vigorous, and rooting was very abundant.

Growth and nitrogen metabolism of squash seedlings, I-III, M. E. REM (*Amer. Jour. Bot.*, 16 (1929), No. 10, pp. 847-849).—Three papers of the series are noted.

I. *Variations at different seasons of the year* (pp. 847, 848).—Analyses at Yale University of squash plants grown in pulverized quartz with and without nitrogen showed that nitrogen causes increased growth of all organs but more so in June- than in December-grown plants. Synthesis of carbohydrates proceeded less rapidly in December, and their lack is deemed the factor limiting growth at that season. Leaves of the December unnitrated plants grew for a longer time and kept green longer than did the comparable June lot. In December plants more of the total nitrogen was in the leaves, while in June more of the nitrogen was in the roots.

II. *With respect to stages of development* (p. 848).—Following changes in nitrogen content in June plants grown without external supply of nitrogen, the author noted that leaves continued to grow until the available food reserves of the cotyledons were exhausted. Stems elongated more during the later phases of seedling growth, while roots grew continuously until final harvest. Yellowing of leaves was associated with a loss of plasma from the chloroplasts and a marked loss of nitrogen. Only a small portion of the nitrogen lost from decomposing leaves is believed available for the younger leaves. The amount of nitrogen in the roots was relatively constant at various stages. Observations on shaded plants indicated that the differences observed between June and December cultures are brought about by light differences.

III. *With respect to high- and low-carbohydrate synthesis* (pp. 848, 849).—A study of unnitrated squash plants grown in relatively low and relatively high carbon dioxide atmospheres showed increased green and dry weight, longer and heavier stems, much larger root systems, smaller total leaf areas, and greater development of supporting tissues in the high carbon dioxide lot. Starch and reducing substances were also much more abundant in all tissues, and the chlorophyll content of the leaves diminished relatively early. In the high carbon dioxide plants more of the total nitrogen was located in the roots and stems and less in the leaves. The author concludes that seasonal differences in growth and utilization of reserve nitrogen may be largely accounted for by differences in the amount of total carbohydrate constituents.

Influence of phosphorus deficiency on the metabolism of tomato plants, S. H. ECKERSON (*Amer. Jour. Bot.*, 16 (1929), No. 10, p. 852).—Studies at the Boyce Thompson Institute for Plant Research of tomato plants grown in sand and watered with solutions lacking in phosphates showed increased acidity in all tissues as the inorganic phosphorus was used up. Nitrate-reducing substances decreased rapidly in succession in the leaves, stems, and roots. Nitrates accumulated and starch increased in the leaves and parts of the stem. Outward manifestations were earlier blooming, stiffening of the stems, purpling of the leaves, fewer glandular hairs, and decrease in characteristic tomato odor. Recovery up to this stage was possible with the addition of phosphates.

Further studies on the respiration of tomato fruits, F. G. GUSTAFSON (*Amer. Jour. Bot.*, 16 (1929), No. 10, p. 843).—Measurements of the anaerobic respiration of tomatoes in nitrogen showed continuance of respiration for from 70 to 100+ hours. With the exception of fruits that were turning pink at the beginning of the test, the amount of carbon dioxide produced at the end was at least 50 per cent of the beginning as compared with 70 per cent for controls in oxygen. The introduction of air following a period of nitrogen respiration resulted in a sudden and large increase in respiration. With tomato leaves the production of carbon dioxide declined to 10 and 3 per cent of the original within 24 and 48 hours, respectively.

Cannery tomatoes: Results of three years' tests of varieties, F. W. GEISE (*Maryland Sta. Bul. 318* (1929), pp. 255-276, figs. 7).—Cooperative tests conducted in 1926, 1927, and 1928 by the station and the extension service in the important tomato-producing regions of the State showed the Marglobe to be slightly the most productive in the Coastal Plain region, the odds being only 14.6 to 1. Combining productivity with resistance to *Fusarium* wilt, a disease found widely distributed in the Coastal Plain area, Marglobe is deemed of outstanding value. In a test at College Park, Marglobe graded the highest percentage of U. S. No. 1 stock and yielded more cases of canned tomatoes per ton of raw stock than any other variety.

The Greater Baltimore, Indiana Baltimore, and Columbia, all of the Baltimore type, produced the highest yields in the Piedmont region, with little preference between the varieties named. Based on the date of the first harvest, Bonny Best is classified as early, Marglobe early to midseason, Greater Baltimore, Columbia, Indiana Baltimore, and Tri-State midseason, and Stone and Norton midseason to late. The harvest period for Bonny Best was 39 days, with 45 to 48 days for the other varieties. Marglobe had the longest harvest season of all. Tri-State yields were unusually evenly distributed through the harvest period, while Bonny Best yielded 70 per cent of the crop in the first three pickings.

The rooting of woody cuttings considered from the standpoint of anatomy, W. A. SLEDGE (*Jour. Pomol. and Hort. Sci.*, 8 (1930), No. 1, pp. 1-22, figs. 7).—In experiments with privet, sycamore, apple, and forsythia cuttings collected monthly throughout the year, the author found that in cuttings taken from dormant shoots and placed in propagating frames cambial activity commences at the base of the cutting and roots may form prior to the downward spread of activity from the buds, thus presenting two distinct and opposed gradients of cambial activity. Rooting was not secured in apple cuttings despite good callusing and active growth of the cambium. Cambial activity and root production were not necessarily dependent or initiated by the growth or presence of buds.

The distribution of air in the intercellular spaces of the cutting is believed to have an important relation to meristematic activity, suggesting the hypothesis that a wound stimulus functioning through the injection of the intercellular spaces around the region of the cambium is an important factor in the initiation of basifugal cambium activity. The restriction of cambial activity to the proximal end of internodal cuttings accounts for the polarized root production always associated with this end.

Ornamental dwarf fruit trees, E. ARJOENSON (*New York: A. T. De La Mare Co.*, 1929, pp. 65, figs. 25).—An explanation and discussion of the training and culture of dwarf fruit trees in the home garden.

Building young deciduous fruit trees, F. M. COE (*Utah Sta. Circ. 84* (1930), pp. 32, figs. 19).—A general discussion of the pruning and training.

Planning, planting, and caring for the young orchard, F. M. COE (*Utah Sta. Circ. 83* (1930), pp. 32, figs. 9).—A general discussion.

Experiments on the effects of leaching with cold water on the foliage of fruit trees.—I, The course of leaching of dry matter, ash, and potash from leaves of apple, pear, plum, black currant, and gooseberry, T. WALLACE (*Jour. Pomol. and Hort. Sci.*, 8 (1930), No. 1, pp. 44-60, figs. 15).—Having shown in an earlier paper (*E. S. R.*, 55, p. 837) by Mann and the author that potassium compounds may be lost from apple leaves by leaching in cold water, this paper presents data on several fruits, taking up also the loss of dry matter and ash.

Healthy leaves of the apple, pear, plum, black currant, and gooseberry, when immersed at laboratory temperatures in distilled water for four successive periods of 24 hours, lost considerable proportions of potassium, ash, and dry matter, ranked in the order given. Plum varieties varied in their resistance to leaching, the Victoria being extremely resistant. Of the several species, the black currant was least readily leached. The leaching processes were continuous, and curves for potassium, ash, and dry matter losses were similar, suggesting that the same groups were being lost throughout the process.

A comparison of the transpiration rates of twenty-one deciduous fruit species, V. W. KELLEY (*Illinois Sta. Bul. 341* (1930), pp. 93-116, figs. 2).—Utilizing as plant material current season shoots from a wide range of fruit and nut plants, there were found marked differences in transpiration rate, as measured in potometers kept in a large, well ventilated laboratory in which light, temperature, and air circulation were uniform for any one test. The 20-odd species divide easily into three groups of high, medium, and low transpiration rates. Coordinating the recorded rates with the degree of drought resistance of the species, as reported by various horticulturists, there was evident a very close relationship, the nonresistant species having a high transpiration rate and the resistant species a low rate.

No correlation was established between the number of stomata per unit area of leaf surface and transpiration rate. In the species studied, transpiration rate was in general more rapid during the day than at night as a result of closed stomata, lower temperature, and higher humidity. Cuttings transpired less with the passing of time, a condition thought due to a reduction in the supply of soluble carbohydrates by respiration and also perhaps to a partial clogging of the vessels at the base of the cutting.

Experiments on the manuring of fruit trees.—III, The effects of deficiencies of potassium, calcium, and magnesium, respectively, on the contents of these elements, and of phosphorus in the shoot and trunk regions of apple trees, T. WALLACE (*Jour. Pomol. and Hort. Sci.*, 8 (1930), No. 1, pp. 23-43).—Observations upon the growth and chemical composition of leaf and shoots of Stirling Castle apples, grafted on Malling Type I rootstocks and growing in sand watered with four different nutrient solutions, namely, complete, minus calcium, minus magnesium, and minus potassium, showed significant effects of the differential treatments. In respect to shoot growth, the omission of potassium, calcium, and magnesium resulted, respectively, in an increase, slight increase, and a marked decrease. After two seasons the trees without magnesium were unable to make appreciable growth.

Large reductions in potassium oxide and magnesium oxide contents of the ash of various parts of the tree were affected by the omission of these bases, but the lack of calcium oxide did not have as much effect. The omission of any one of the three bases usually resulted in an increased percentage of the others in both ash and dry matter. Some evidence was secured that the respective omissions influenced the phosphorus content in the dry matter of the various growths. Finding wide differences in the content of ash and of ash constituents in the bark and wood portions of one- and four-year-old main stems, the author points out the necessity of separate analyses.

Sprays, their preparation and use, R. H. ROBINSON (*Oregon Sta. Bul. 259* (1930), pp. 27, fig. 1).—The preparation of insecticides and fungicides that may be manufactured at home is discussed in detail. Indicating the practices and precautions that must be observed to render the best results, general information is given upon the physical and chemical properties of various commercial spray materials and upon their stability and compatibility with other spray

substances. A compatibility chart showing graphically safe and dangerous combinations is included.

[Spray schedules for New Jersey fruits] (*New Jersey Stat. Circls.* 220 (1930), pp. 7; 221, pp. 4; 222, pp. 4; 223, pp. 3; 224, pp. 2).—These circulars entitled, respectively, 1930 Spraying Recommendations for Apples, 1930 Spray Schedule for Plums and Cherries, 1930 Spray Schedule for Peaches, 1930 Spray Schedule for Pears, and 1930 Spray Schedule for Grapes present concise information on the when and why of spraying.

The effect of dusting-sulfur upon the germination of the pollen and the set of fruit of the apple, L. H. MACDANIELS and J. R. FURE (*New York Cornell Sta. Bul.* 499 (1930), pp. 13, pl. 1, fig. 1).—That sulfur dusts may under certain conditions interfere with apple pollination was shown in laboratory and field studies. Where sulfur was applied to one-half of a culture of pollen the percentage of germination was decreased or nearly inhibited, and the pollen tubes that grew were shorter in length, as compared with checks. Where sulfur was applied directly on the stigmas 24 hours before, coincident with, and 24 hours after pollination, with untreated blooms on the same spur as checks, the sets of the sulfur dusted flowers were materially reduced with one or two species, being 0 in all cases where the pollen and sulfur were applied simultaneously. Comparable results were secured with branches of blossoms inclosed in cheesecloth, except that with a single dusting the variation in time of flower opening resulted in a considerable set on dusted branches. A Wealthy tree dusted once while in full bloom yielded a good set of fruit, while a Northern Spy tree dusted 9 days in succession set only a small crop. A single dusting of McIntosh trees where the set was naturally very light because of inadequate pollination reduced the set below the controls, suggesting that the use of sulfur may be more harmful on naturally light-setting than heavy-setting varieties.

The time of differentiation of the flower-bud of the apple, M. A. GIBBS and T. SWABERICK (*Jour. Pomol. and Hort. Sci.*, 8 (1930), No. 1, pp. 61-66, pl. 1).—Studies at the Long Ashton Research Station, England, upon flower bud differentiation in the spur and axillary buds of the Lane Prince Albert apple grown on Malling Type II roots showed differentiation in spur buds on one- and two-year wood during the last two weeks of June, with sepal primordia distinct on July 2. In axillary buds on current wood, differentiation occurred considerably later, although the initial date was not established. However, axillary buds developed rapidly, so that at the end of the growing season there was little or no difference in the stage of development of the various buds.

Physiology of fruit.—I, Changes in the respiratory activity of apples during their senescence at different temperatures, F. KIDD and C. WEST (*Roy. Soc. [London], Proc., Ser. B*, 106 (1930), No. B 742, pp. 93-109, figs. 2) — A discussion of the results and the principles underlying them as secured at the Low Temperature Research Station, Cambridge, England, with apples stored at constant temperatures of 25, 10, and 22.5° C.

It was found that from four to six apples are too few to give a reliable sample for any one treatment. Very marked individual variation was noted in the life of any given lot of apples held at a constant temperature. The carbon dioxide output of diseased apples rose rapidly with the progress of the fungus, necessitating the removal of diseased fruit from the test.

At 25, 10, and 22.5° respiratory activity rose at first and then declined. The peak value was in all three cases about 1.5 times the initial value, but the time required to reach the peak of respiration varied inversely with the temperature. At 25, 10, and 22.5°, 23.4, 8.1, and 4.7 gm. of carbon dioxide were,

respectively. liberated before the peak was reached, but the total amount liberated and also the dry matter lost from harvest to death were approximately equal at all three temperatures. The duration of life at 2.5, 10, and 22.5° was 205, 97, and 41 days, respectively. At all temperatures death by fungal disease intervened after approximately the same total amount of carbon dioxide was evolved.

Three factors are believed largely responsible in carbon dioxide output, namely, effective concentration of substrate, effective concentration of enzymes, and temperature. Acid, cane sugar, and hexose sugar were present at harvest in sufficient quantities to serve as a source of carbon dioxide. However, maximum respiration occurred earlier than maximum hexose concentration, suggesting no direct correlation between the two. The author concludes that the acceleration and deceleration of respiratory activity during senescence is probably largely due to changes in the colloidal state of the protoplasm.

Experiments on the storage of pears in artificial atmospheres, S. A. TROUT (*Jour. Pomol. and Hort. Sci.*, 8 (1930), No. 1, pp. 78-91, fig. 1).—Observations on Conference pears stored in a hard ripe condition at 3, 10, and 18° C. in glass containers containing nitrogen and carbon dioxide in various proportions showed harmful results at all three temperatures when the oxygen-free atmosphere contained more than 10 per cent of carbon dioxide. Short exposures in oxygen-free atmospheres of less than 10 per cent carbon dioxide delayed ripening, the best results being obtained at 3° (38.3° F.) in a less than 10 per cent carbon dioxide atmosphere.

In a second experiment with Conference pears in nitrogen alone at 5, 10, 15, and 18° C., the greatest extension of life was obtained at 5°. In the case of Clairgeau pears, all fruits stored in air developed scald while still hard, while pears held in nitrogen for 2, 4, 6, 8, and 10 days ripened normally without scalding.

Determinations of the amount of acetaldehyde found in pears stored in nitrogen showed a direct relation of this material with the amount of carbon dioxide evolved. In a given period of time the accumulation of acetaldehyde in the tissue was greatest at the highest temperatures, but the acetaldehyde-carbon dioxide ratio was approximately the same at all temperatures. The author suggests that the chain of causation of acetaldehyde formation is breakdown, water logging of tissue, anaerobic conditions with carbon dioxide accumulation, and acetaldehyde formation.

The gas storage of fruit.—II, Optimum temperatures and atmospheres, F. KIDD and C. WEST (*Jour. Pomol. and Hort. Sci.*, 8 (1930), No. 1, pp. 67-77, figs. 2).—Having shown in an earlier contribution² from the Low Temperature Research Station, Cambridge, England, that an artificial atmosphere containing less oxygen and more carbon dioxide than normal air retards ripening processes in the apple and that the effects of any given concentration vary with the temperature, further studies were made to determine desirable concentrations.

Bramley Seedling apples picked October 4 and placed under treatment October 23 in three temperatures, 1, 5, and 10° C., in 10 differential gas combinations were employed in the study. Fungal decay was first noted in January in the air-stored fruit held at 10°. The first breakdown at 1° occurred in February. At 1° controlled artificial atmospheres were in all cases less efficient than air, while at 5 and 10° the reverse was true. The degree of efficiency of any given concentration of carbon dioxide depended both on

² Gas Storage of Fruit, F. Kidd, C. West, and M. N. Kidd. [Gt. Brit.] Dept. Sci. and Indus. Research, Food Invest., Spec. Rpt. 30 (1927), pp. VII+87, figs. 50.

temperature and upon oxygen concentration. The retarding influence of reduced oxygen was not as great as that of increased carbon dioxide. The most effective combination was 5° in an atmosphere of 10 to 15 per cent carbon dioxide and about 10 per cent of oxygen, the fruit keeping 50 per cent better in this than in normal atmosphere at 5°. Change of color was retarded even more than ripening. At 1° the worst breakdown resulted from a high carbon dioxide and low oxygen content. The presence of carbon dioxide apparently increased the susceptibility of apples to breakdown.

Studies of carbohydrate, acid, and total dry matter changes of apples stored at 10° in three different artificial atmospheres showed that the average rate of loss of carbohydrates by respiration was between 1.2 and 1.4 times more rapid in air than in 10 per cent oxygen and between 1.35 and 1.55 times faster in 0 than in 10 per cent of carbon dioxide. The changes were not all proportionately retarded by artificial atmospheres; in early stages of storage cane sugar was actually lost faster in the presence of carbon dioxide than in air. Acid changes were not markedly affected by the changes of atmosphere.

Pollen sterility in the Collinson avocado, T. R. ROBINSON (*Jour. Heredity*, 21 (1930), No. 1, pp. 34-38, figs. 2).—Collinson, a variety of avocado developed at the United States Plant Introduction Garden near Miami, was found upon controlled tests to be pollen sterile but highly capable of setting fruit when cross-pollinated.

The Wonderful variety of pomegranate: Composition, commercial maturity, and by-products, E. M. CHACE, C. G. CHURCH, and H. D. POORE (*U. S. Dept. Agr. Circ.* 98 (1930), pp. 16, fig. 1).—Seeking to establish satisfactory maturity standards and to develop methods for utilizing surplus and cull pomegranates, analyses were made of fruit gathered at different stages of maturity. There was found a gradual increase in soluble solids and sugars and a loss in acid as the season progressed. Sugar increases were relatively more rapid than that of solids. Sucrose was sometimes present in small quantities, ranging from traces to 1 per cent. The flavor of the juice was largely dependent on acid and sugar contents, and, as a rule, fruits of low acidity were rich in sugars. A percentage of 1.85 per cent acidity was established as a satisfactory index to shipping maturity, but later it was found that color of the juice should also be considered, a point of 20 Red plus 1 Yellow on the Lovibond scale being set as standard. Color was not correlated with acidity and could not, therefore, be used as a lone index.

In utilizing culls from commercially mature fruit for beverage purposes, it was found necessary to separate out the tannin by means of gelatin. In one case 103 gal. of juice was expressed from a ton of fresh fruit, the average being from 80 to 90 gal. The manufacture of beverages and jelly is discussed.

An experiment with urea on supplies in old tea fields, E. C. MARSH-SMITH (*Trop. Agr. [Ceylon]*, 73 (1929), No. 6, pp. 367, 368).—Plants furnished a solution of urea "were healthy with very dark leaves in comparison with the controls, the leaves of which were pale or yellowish in many cases," but the difference in size between treated and untreated plants appears not to have been appreciable.

Southern California gardening, E. B. TRASK (*Pasadena: Author*, 1929, pp. 64, pls. 7).—This manual, designed for the amateur, outlines for each successive month the activities to be carried on and the plant material to be used in the home flower garden.

Perennials of flowerland, A. T. A. QUACKENBUSH (*New York: Macmillan Co.*, 1929, pp. [6]+258).—A description is given of a number of perennials, with notes on their origin, history, and cultural requirements.

Better sweet peas, G. J. BALL (*Chicago: Florists' Pub. Co., 1930, [2. ed.], pp. [7]+210, pls. 1, figs. 29*).—A second edition of a previously noted book (E. S. R., 51, p. 243).

FORESTRY

Forests and mankind, C. L. PACK and T. GILL (*New York: Macmillan Co., 1929, pp. [XIII]+250, pls. 24, figs. 39*).—A discussion upon the growth habits of trees, upon forests and forestry practices in different parts of the world, forest products, the wild life of the forest, forest enemies, forest conservation, etc.

Vanishing forest reserves, W. G. VAN NAME (*Boston: Richard G. Badger, 1929, pp. X+190, pls. 24, figs. 2*).—A discussion of the timber situation in the national forests and national parks.

Annual report and program of the Southern Forest Experiment Station, 1928 ([*U. S. Dept. Agr., Forest Serv., 1928*), pp. [2]+23).—Part of this mimeographed report is devoted to the results of investigational studies.

At McNeill, Miss., it was found that leaf litter on annually burned areas was able to absorb only one-seventh as much moisture as did litter on an adjacent plat not burned for six years. Measurements at Urania, La., of 50 longleaf pines left after cutting showed a greatly accelerated growth rate following release from competition. The increase in diameter was greater near the base of the tree and more pronounced in small than in large trees.

Of several methods of chipping compared on slash pine, narrow chipping (0.25 in. in depth) gave 6 and 7 per cent larger yields, respectively, over a 5-year period than were obtained from 0.5 and 0.75 in. The advantage of narrow chipping was obtained during the fourth and fifth years as a result of evaporation and wastage from long faces. In longleaf 0.5-in. chippings gave the highest and 0.25 in. the lowest yields. In respect to the depth of chipping 0.5 in. proved the best in both species. Comparing the American with the French method of chipping, 17.5 per cent larger yields were obtained in 1928 with the French system.

Recording the effects on yield of gum of slash pine trees fertilized with ammonium sulfate, muriate of potash, superphosphate, and phosphate screenings, there was noted some beneficial effect from the nitrogen fertilizer, with apparently depressed yields from the other three, particularly the muriate of potash. Studies of the gum flow showed larger yields during the day than at night.

Germination studies with longleaf pine seed stored in metal cans showed a very sharp decrease in May, dropping from 70 per cent to about 20 per cent, accompanied by a slower germination.

Zinc sulfate was not effective in suppressing grass in nursery beds at Bogalusa, La., the pine seedlings succumbing with doses heavy enough to kill grass. Longleaf pine continued to show the highest survival of any species planted at Bogalusa.

At McNeill, Miss., studies were conducted upon the effect of various grazing and burning treatments on the survival of longleaf pine and showed tentatively the desirability of grazing as a means of reducing fires. Grazing had no apparent harmful effect except on carpet grass areas. An examination of soil taken from burned and protected areas indicated that the soil from the protected area was higher in moisture, less dense, and more porous.

The Eli Whitney Forest, R. C. HAWLEY and W. MAUGHAN (*Yale Univ. School Forestry Bul. 27 (1930), pp. 46, pls. 59, fig. 1*).—This profusely illustrated publication, setting forth forest conditions and details and methods of forest management on the Eli Whitney Forest located in the vicinity of New

Haven, Conn., is offered as a contribution toward solving some of the forestry problems with which owners of comparable woodland are confronted and with a view to interesting private owners in forest management.

Hastening the germination of some coniferous seeds, L. V. BARTON (*Amer. Jour. Bot.*, 17 (1930), No. 1, pp. 88-115, figs. 4).—Continuing earlier work (*E. S. R.*, 60, p. 237), data are presented on the results of stratification experiments at the Boyce Thompson Institute for Plant Research with a large number of conifers.

In general, stratification in moist acid peat at 5° C. for a period of 2 months hastened germination and in most cases resulted in a larger number of seedlings. Various exceptions were noted; for example, with *Pinus excelsa* 3 months at 10° gave the best germination, and *P. cembra* and *Sequoia sempervirens* seed failed to germinate under any treatment, although cutting tests of the latter species showed 11.3 per cent of good embryos.

Growth and its relation to thinning: Sample plot studies in mixed hardwood stands, C. H. GUISE (*Jour. Forestry*, 28 (1930), No. 1, pp. 16-22).—Further records (*E. S. R.*, 52, p. 841) taken in 1929 on thinned and unthinned sample plats established by Cornell University in 1914 in a mixed hardwood stand in Cayuga County showed positive results from thinning. Despite the removal of 11.44 and 8.2 cords per acre from the thinned plats, they had closely approached the volume of the unthinned plat. However, since the rate of growth in all plats had become about equal, the author suggests the impending need of a second thinning. Mortality was practically nil in the thinned plats as contrasted with a total loss of 22 per cent in the unthinned.

Girdling hardwoods to release spruce and balsam fir, M. WESTVELD (*Jour. Forestry*, 28 (1930), No. 1, p. 101).—Comparing at 5-year intervals the growth in a series of three plats, (1) heavy girdling and removal of hardwoods, (2) moderate girdling and removal of hardwoods, and (3) control, established in 1905 by the U. S. D. A. Forest Service in a New Hampshire hardwood stand containing an understory of spruce from 2 to 6 ft. high, there was found a much more rapid volume gain of girdled than control plats. The value of the spruce on the three plats at the end of 22 years was in the ratio of \$40, \$25.20, and \$6.80, respectively. The costs of girdling with accumulated interest are given as \$6.14 and \$4.50 for the heavily and moderately girdled plats.

Small trees wasteful to cut for saw timber, W. W. ASHE (*U. S. Dept. Agr. Leaflet* 55 (1930), pp. II+5, figs. 3).—Presenting data on the number of board feet, quantity of logs, and time required to produce 1,000 bd. ft. from trees of different diameters, the author shows the greatly increased cost of handling the smaller sized trees.

The taxation of forest lands (*Ohio Sta. Forestry Pub.* 1 [1925], pp. 4).—A brief explanation is presented of the provisions and operation of a State law to decrease taxation on forest lands.

DISEASES OF PLANTS

[Plant pathology at the Arkansas Station] (*Arkansas Sta. Bul.* 246 (1929), pp. 31, 63-67).—Studies by W. H. Metzger and G. Janssen of the cause of chlorosis in rice led to the following conclusions: (1) The sodium ion in such concentrations as are usually encountered is not toxic to rice. (2) The nitrate radical at ordinary concentrations is also nontoxic. (3) Nitrates are somewhat rapidly reduced in flooded soil, and a very great portion of the nitrogen is lost by denitrification in the reduction process. (4) Chlorosis, in these experiments, was due to a lack of available nitrogen rather than to nonavailability of iron.

As determined by V. H. Young, J. O. Ware, and Janssen in studies of the cotton wilt organism grown on various liquid nutrient media and also on a single medium but with varying amounts of nitrate, there was at first an increase in the dry weight of mycelium followed by a decrease. Accompanying the decrease, there was an increase in the production of ammonia in the culture fluid. There was noted a definite trend toward alkalinity, finally reaching pH 9, at which point the phosphate was precipitated.

Nitrites were never greater than 0.086 and 2.66 parts per million, respectively, when Giltay's and Richard's solutions were used as media. Slight differences were noted in the nitrite-producing capacities of the several strains of *Fusarium vasinfectum*. In Duggar's solution an increase in nitrates increased the production of nitrites. The rate of mycelial growth within certain limits also increased with increases in nitrates. Two theories for the production of ammonia in culture solutions are advanced. (1) Lack of sugars may result in starvation phenomena, ammonia thereby becoming a by-product, and (2) the organism may undergo autolysis as a result of by-products in the form of toxins produced in the nutrient solution.

Tests of 25 cotton varieties for wilt resistance under field conditions showed a wide variation ranging from 44 per cent in the susceptible Trice 304 to a bare trace in the resistant varieties. Several varieties were found to combine resistance with other desirable qualities.

Temperature relations of the wilt organism were studied by Young, who tentatively reports that little wilt develops until real warm weather prevails. No marked differences were found by A. L. Smith between various biological strains of the cotton wilt fungus with respect to color on standard media, type of spore production, vigor of growth, pathogenicity, and in their effect on the H-ion concentration of the culture medium.

Information is again presented by H. R. Rosen (E. S. R., 60, p. 829) on hosts of fire blight and their relation to the overwintering of the organism. A study by L. Shaw of a yellow schizomycete found as a secondary invader of fire blighted tissues showed that this bacillus is capable of completely destroying the fire blight organism under certain conditions. When the two bacteria were introduced into wounds on healthy pear shoots, the activities of the fire blight were not materially inhibited, but when young leaf clusters were sprayed with both bacteria, the number of stomatal invasions and the resulting infections were greatly reduced.

Studies by Rosen of the effects of spraying Jonathan apple trees with lime sulfur and Bordeaux mixture for the control of fire blight during the blossoming period showed apparently beneficial results. Bordeaux mixture applied while the blossoms were open did not interfere with pollination, but the amount of russeting was somewhat increased as compared with lime sulfur, which was applied in the cluster bud and calyx stages.

Dividing rice diseases into two major groups, those induced by microorganisms and those by physiological disturbances, it was found by E. C. Tullis that about 90 per cent was in the first group, which included stem rot (*Sclerotium oryzae*), *Helminthosporium* sp., *Piricularia* sp., *Ophiobolus* sp., *Corticium vagum*, and *Tilletia horrida*. The last named, a smut, is said to cause but little loss in Arkansas due to the absence of susceptible varieties. Physiological diseases include "straight head" and a trouble associated with an alga (*Chara* sp.).

Studies in the inheritance of resistance to leaf rust, *Puccinia anomala* Rostr., in crosses of barley, I, W. L. WATERHOUSE (*Roy. Soc. N. S. Wales, Jour. and Proc.*, 61 (1927), pp. 218-247, pls. 2).—Glasshouse tests with 119 barley varieties in 6 species in connection with 1 Australian physiologic form of *P. anomala* showed 16 of the forms, all in *Hordeum vulgare* and *H. distichon*,

to possess strong resistance to rust, though none of the 16 was entirely suited agronomically to conditions in New South Wales.

Studies through 3 generations of crosses of some of these resistant forms showed in the F_1 resistance completely dominant, and in the F_2 a ratio of 3 resistant plants to 1 susceptible. The F_1 generation studies supported the hypothesis that a single dominant genetic factor underlies resistance. Tests of certain varieties supposedly indicate correlation between resistance to *Helminthosporium sativum* and leaf rust.

Inheritance of the second factor for resistance to bunt, *Tilletia tritici*, in Hussar wheat, F. N. BRIGGS (*Jour. Agr. Research* [U. S.], 40 (1930), No. 3, pp. 225-232, figs. 2).—Having presented evidence in an earlier paper (E. S. R., 55, p. 129) of the existence in the Hussar wheat of two factors, *MM* and *HH*, for resistance to bunt, further data are presented on the inheritance of the *HH* factor.

Using as one parent selection No. 1418, which contained the *HH* but not the *MM* factor, and as the other parent the susceptible Little Club variety, a careful study was made of the resulting F_1 and F_2 generations. Unlike the completely dominant *MM* factor, the *HH* factor allowed about 50 per cent of the heterozygous progeny to become infected. Crossing the Martin variety, possessing the *MM* factor for resistance, with selection No. 1418 and studying the F_2 and F_3 , it was noted that the factors in Martin and in No. 1418 are the two main factors for resistance to bunt in the Hussar variety. In respect to resistance the Martin and Hussar wheats are, respectively, designated as *MMhh* and *MMHH*.

Inheritance of resistance to bunt, *Tilletia tritici*, in White Odessa wheat, F. N. BRIGGS (*Jour. Agr. Research* [U. S.], 40 (1930), No. 4, pp. 358-359, fig. 1).—Crossing a strain of White Odessa wheat, which developed no bunted heads at Davis, Calif., during the 3-year period 1926-1928, with White Federation, a highly susceptible variety, records were taken on bunt resistance of the second and third filial generations with seeds inoculated prior to planting. There developed 22.3 per cent of bunted plants in the F_2 generation, approximating the 3:1 ratio expected on the basis of a single factor for resistance. In F_2 299 rod rows grown from 299 F_1 plants which had been protected from bunt by seed treatment with copper carbonate, the observed segregation as determined by the percentage of bunted plants in each row was also suggestive of a single factor for disease resistance. This factor was similar in its effect to that found by the author in Martin wheat (see above) and is considered possibly identical. The importance of isolating the various factors concerned with bunt resistance and determining their reaction to the different physiological strains of the disease is stressed.

Thresher injury a cause of baldhead in beans, L. L. HARTER (*Jour. Agr. Research* [U. S.], 40 (1930), No. 4, pp. 371-384, figs. 4).—Baldhead, an injury characterized by the partial or entire absence of the primary leaves and growing tips on newly germinated seedlings and occurring at times to the extent of from 10 to 30 per cent in highly susceptible varieties, such as Bountiful, Refugee, and Improved Kidney Wax, was found to be caused in a large part at least by injuries to the seeds during threshing. Histological studies of the epicotyledonary regions of the embryos of seeds from machine-threshed and hand-threshed beans showed that the epicotyl may be fractured just below the plumule in the threshing process. The injury was rarely found in beans threshed by hand. Injured plants often developed buds in the axils of the cotyledons and produced small shoots which bore a few flowers and possibly a few pods. Field bean varieties and also dry-shell beans were rarely injured.

A study of the mosaic disease of crucifers, E. E. CLAYTON (*Jour. Agr. Research* [U. S.], 40 (1930), No. 3, pp. 263-270, figs. 2).—Studying the degree of susceptibility of cabbage, cauliflower, and Brussels sprouts as grown on Long Island, N. Y., to a mosaic disease commonly occurring on rutabagas, it was found that Brussels sprouts and cauliflower are susceptible to infection but only to a moderate degree. Cabbage was either highly resistant or immune, although it apparently acted as a carrier.

Temperature was an important factor in determining the effects of the disease. At from 70 to 80° F. mustards and Chinese cabbage developed streak and were much stunted. At from 55 to 65° even the more susceptible species made fair development, while in the less susceptible species the presence of the disease was entirely concealed.

In conclusion the author asserts that cruciferous mosaic will likely continue as a minor disease on Long Island because of the marked resistance of cabbage, cauliflower, and Brussels sprouts, and also because these plants are grown chiefly in the cooler parts of the year.

A review of contributions to potato pathology which appeared in American publications during the year 1927, J. E. KOTILA (*Potato Assoc. Amer. Proc.*, 14 (1927), pp. 226-232).—The contributions to potato pathology which appeared in American publications during 1927 are reviewed in groups as dealing with virus, fungus, or bacterial diseases of the potato.

A summary of the important contributions to potato pathology which have appeared in foreign periodical literature in the past year, F. WEISS (*Potato Assoc. Amer. Proc.*, 14 (1927), pp. 215, 218-225).—This account, giving 27 citations to the literature, deals separately with virus, fungus, bacterial, and nonparasitic diseases of potato.

Hollow heart of potatoes: Occurrence and test of thiourea seed treatments for prevention, H. O. WERNER (*Potato Assoc. Amer. Proc.*, 14 (1927), pp. 71-88, figs. 6).—In a previous paper (E. S. R., 57, p. 730) the author showed the prevalence of association between potato hollow heart and larger tuber size, presence of spindle tuber, small number of stems per plant, and cylindrical shape, besides other correlations.

In the present work, done in 1927 at the Nebraska Experiment Station, hollow heart occurred most frequently in the case of plants having few stems and in tubers characterized by growth cracks, large size, and poor type.

Treating cut seed pieces with solutions of thiourea gave an increase in number of stems and tubers, with a decrease in tuber size and in hollow heart. These effects were definitely in direct proportion to the length of the treatment or the concentration of the solution, tuberized pieces responding as did those freshly cut. Similar results were obtained when the seed piece size was increased, though great increase in size was necessary to equal the effect of most thiourea treatments.

Transmission studies of virus diseases of potatoes in Michigan, 1926-27, J. E. KOTILA (*Potato Assoc. Amer. Proc.*, 14 (1927), pp. 95-101, figs. 2).—Using the plug and cutting knife methods of transmission employed by Goss (E. S. R., 58, p. 654) in attempts to transmit spindle tuber, spindling sprout, leaf roll, mild mosaic, streak, and giant hill from diseased to healthy tubers, the author reports from the Michigan Experiment Station that he was able to confirm the findings of Goss and of others. The cutting knife apparently transmitted virus more readily than did grafting, on account supposedly of the failure of grafts to unite. Spindle tuber and mild mosaic were certainly, and leaf roll probably, transmitted by the cutting knife method. Giant hill and hereditary spindling sprout were not so transmitted.

Successful transmission of virus by means of the knife seemed to depend upon the prevention of drying of the cut seed. The cutting knife is not considered a serious transmitting agency.

Mosaic control by tuber indexing method as applied to the Triumph variety, J. G. MILWARD (*Potato Assoc. Amer. Proc.*, 14 (1927), pp. 88-91).—The results of indexing for potato mosaic control at the Wisconsin Experiment Station during several years are tabulated.

During the winter of 1926-27, 25 bu. of seed tubers of the variety Triumph, averaging about 6 oz. in weight and about 0.5 per cent mosaic, were selected and these seed tubers freed from apparent mosaic, the stock then being seeded (4 hills to each tuber) on a 2-acre index plat in 1927. The records showed about 16 hills (representing 4 potatoes) rogued during the growing season. The field gave 300 bu. of foundation seed, which tested in the greenhouse not over 10 mosaic plants out of 4,000 plants indexed. This record is approximated by results from a limited number of cooperative tests by growers in the Triumph-producing belts. Attention is called to certain problems involved in the application of this work in the field, as well as to the possibilities of this and of related work.

The value of organic mercury compounds in the control of seed and soil borne scab, W. H. MARTIN (*Potato Assoc. Amer. Proc.*, 14 (1927), pp. 102-108).—In studies continued for several years at the New Jersey Experiment Stations, the organic mercury compounds used in the form of an instantaneous dip at concentrations of 1:10, 1:20, 1:24, 1:30, and 1:40 gave control of potato scab equal to or better than that resulting from the use of the standard 15-hour treatment with mercuric chloride. At the lower concentrations, the cost was less than that of the present mercuric chloride treatment. Before-cutting and after-cutting treatments showed no very decided differences as regards yields. In view of the fact that the after-cutting treatment supposedly leaves the seed piece in a rather undesirable condition, the author advises that only uncut seed should be treated until more is known on this point.

The results as to efficacy of the organic mercury compounds as soil disinfectants (when not used in such excess as to damage the crop) are regarded as very encouraging.

Seed potato treatments in 1927, C. R. ORTON and G. F. MILES (*Potato Assoc. Amer. Proc.*, 14 (1927), pp. 117-120).—Presenting results from data based upon experiments conducted in the chief potato-producing States from Maine to Oregon and New York to Florida, the authors conclude that from the standpoint of control of potato rhizoctonia and scab through seed potato treatment, the instantaneous method with Dipdust does not show as high fungicidal value as does the treatment for 15 hours with corrosive sublimate. However, Dipdust reduces markedly both diseases: and in view of the saving in time and labor and the increase in yield this compound is thought to offer promise to the practical potato grower.

Seed potato treatments for scab control, R. W. GOSS and H. O. WEBNER (*Potato Assoc. Amer. Proc.*, 14 (1927), pp. 109-116).—Experimentation in potato scab control at the University of Nebraska gave much the same results in 1926 as in 1927, so that the latter year only is reported as typical. The hot formaldehyde seed treatment was the most effective in controlling scab, and is regarded as profitable for use with all seed potatoes. The mercuric chloride treatment varied as regards effectiveness and gave better control at Lincoln and North Platte than at Alliance, Nebr. No organic mercury treatment is recommended. None of the treatments affected the yields, nor did the scabby untreated seed result in decreased yield.

Bacterial leaf spot of squash, M. K. BRYAN (*Jour. Agr. Research* [U. S.], 40 (1930), No. 4, pp. 385-391, pls. 3, figs. 3).—A bacterial leaf spot (*Bacterium cucurbitae* n. sp.) found attacking summer and winter squashes and pumpkins is described in detail, both in regard to its appearance on the plant and on various media and also as to its physiological relationships. The bacteria were evidently carried on the seed and were found able to enter healthy leaves by way of the stomata. The leaf spots are brown surrounded by a yellow halo. Although papery, thin, and dry, the spots do not tear and drop out as in the angular leaf spot of the cucumber. Occasionally young stems of the summer squash were attacked, and sometimes very young plants were killed by infection at the growing point. The disease was transmitted to watermelons but not to cucumbers or muskmelons by inoculation, and was never found naturally on watermelons, cucumbers, or muskmelons. A technical description of the pathogene is given.

A comparison of wilt resistant tomatoes in Virginia, F. P. McWHORTER and M. M. PARKER (*Virginia Truck Sta. Bul.* 69 (1929), pp. 787-797, figs. 5).—Continuing earlier work (E. S. R., 61, p. 746), the Invincible tomato, developed at the station as a selection from a Marvel \times Bonny Best cross was compared on several soil types with Stone and Marglobe and found satisfactory, both in respect to resistance to wilt and production. As measured by the percentage of healthy plants, Invincible and Marglobe were about equal in resistance, both being much more resistant than was Stone. On disease-free soils Invincible equaled Stone in productivity. Descriptive notes are presented on the plant and fruit of the Invincible variety. In concluding, the authors suggest that a 4 to 5-year rotation, supplemented with resistant varieties, will tend to free soil of wilt.

Experiments on the treatment of chlorosis in Utah, F. B. WANN (*Amer. Jour. Bot.*, 16 (1929), No. 10, p. 844).—Injections at the Utah State Agricultural College of dry salts, chiefly iron, into holes bored in the stems of grapes, peaches, and apples overcame chlorosis in most cases. The best results were secured with ferric phosphate. Ferric ammonium citrate caused very rapid greening but also burning.

A study of the fire blight pathogen, *Bacillus amylovorus*, within living tissues, H. R. ROSEN (*Science*, 70 (1929), No. 1814, pp. 329, 330).—The relative ease with which infections were secured by injections or by spraying (E. S. R., 60, p. 449) having suggested a reexamination of the methods by which blossom infections are brought about under field conditions upon various hosts, unexpected results were obtained in petalary infections of pear blossoms. The present account notes briefly these results, a more detailed statement of which is to appear later.

When pear blossoms in which the petals are closed and tightly clasped together are sprayed with a water suspension of *B. amylovorus* and then placed in a moist chamber, infections will commonly occur on receptacles, sepals, and petals in from 24 to 48 hours, the number and extent of infections depending upon conditions, a great number occurring in from 48 to 72 hours.

The main purpose of this note is to direct attention to the infections on the petals, the delicate, translucent tissues of which readily allow observation of the living bacteria at magnifications around 800. The pathological phenomena are described. *B. amylovorus* within petals acts as a strict parasite confined, as to growth and reproduction, to living host cells.

[Esca], P. VIALA and P. MARSAIS (*Rev. Vitic.*, 66 (1927), No. 1697, pp. 5-7, pl. 1; 67 (1927), No. 1723, p. 13, pl. 1; 68 (1928), Nos. 1749, pp. 5-8, pl. 1; 1752, pp. 53-57, fig. 1; 1754, pp. 85-88; 1765, pp. 265-269, figs. 3; 69 (1928), No. 1789,

pp. 229-235, figs. 4).—Accounts by Viala and an editorial note by Marsais deal with esca of grapevines as regards the symptoms, significant effects, relations to conditions, and associated organism *Stereum necator*, studies and observations subsequent to accounts previously noted (E. S. R., 58, p. 250) being indicated.

Wastage in Australian fruit exported to England, J. BARKER (*Jour. Council Sci. and Indus. Research [Aust.]*, 1 (1928), No. 5, pp. 261-267).—In apples, wastage has appeared to be due chiefly to bitter pit and in less degree to internal breakdown. In pears, the losses, heavy in 1926 and less extensive in 1927, were due mainly to overripeness. As to grapes, it is stated that with the exception of the Ohanez variety, the condition of the Western Australian varieties, including Black Malaya, Wortley Hall, Red Pounce Colmar, Tehal, and Purple Cornichon, is very unreliable; the principal cause of deterioration being the separation of the berries from the stalk, or "dropping," regarding the factors of which occurrence no critical work appears to have been done. The bearings of the above information on the prevention of wastage are discussed.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Catalogue of birds of the Americas, VI, C. E. HELLMAYR (*Field Mus. Nat. Hist. [Chicago] Pub., Zool. Ser.*, 13 (1929), pt. 6, pp. V+258).—This sixth part of the author's catalogue (E. S. R., 59, p. 549) deals with the Oxyruncidae, Pipridae, Cotingidae, Rupicolidae, and Phytotomidae.

The summer birds of the northern Adirondack Mountains (*Roosevelt Wild Life Bul. [Syracuse Univ.]*, 5 (1929), No. 3, pp. 323-504, pls. 4, figs. 68).—The first contribution deals with The Summer Birds of the Northern Adirondack Mountains, by A. A. Saunders (pp. 323-499), and the second with The Summer Birds of the Adirondacks in Franklin County, N. Y., by T. Roosevelt, jr, and H. D. Minot (pp. 501-504), a reprint of a publication issued in 1877.

Experiments in bird migration.—I, Manipulation of the reproductive cycle: Seasonal histological changes in the gonads, W. ROWAN (*Boston Soc. Nat. Hist. Proc.*, 39 (1929), No. 5, pp. 151-208, pls. 11).—This work includes a list of 57 references to the literature.

Key-catalogue of parasites reported for primates (monkeys and lemurs), with their possible public health importance, and key-catalogue of primates for which parasites are reported, C. W. STILES ET AL. (*U. S. Pub. Health Serv., Hyg. Lab. Bul.* 152 (1929), pp. IV+409-601).—This paper represents part 5 of the authors' Host Catalogue, Index Catalogue of Medical and Veterinary Zoology (E. S. R., 59, p. 586). The key-catalogue of parasites (pp. 420-491) was prepared by Stiles and A. Hassall, and that of primates (pp. 491-580) by Stiles and M. O. Nolan.

Some new parasitic nematodes from Yucatan (Mexico), including a new genus of strongyle from cattle, J. H. SANDGROUND (*Bul. Mus. Compar. Zool.*, 69 (1929), No. 14, pp. 515-524, pls. 2).—Under the name *Bosicola tricoloraris* n. g. and sp., the author describes a new strongyloid parasite of domestic cattle taken in Yucatan, Mexico.

Weather and climate in their relation to insects, B. P. UVAROV (*London: Govt.*, 1929, pp. 20).—This discussion, presented in connection with a list of 39 references to the literature, was prepared for the agricultural section of the Conference of Empire Meteorologists in 1929.

Some methods of technique applicable to entomology, A. D. IMMS (*Bul. Ent. Research*, 20 (1929), No. 2, pp. 165-171).—This is a contribution from the Rothamsted Experimental Station.

On the relative value of parasites and predators in the biological control of insect pests. W. R. THOMPSON (*Bul. Ent. Research*, 19 (1929), No. 4, pp. 343-350).—A brief comparative discussion. It is concluded that the part played by predacious insects has been underestimated, that they are worthy of more careful attention than they have generally received, and that the possibility of their utilization in practical entomological work is considerable.

Multiple parasitism: Its relation to the biological control of insect pests. H. S. SMITH (*Bul. Ent. Research*, 20 (1929), No. 2, pp. 141-149, fig. 1).—This is a contribution from the California Citrus Experiment Station.

Experiments on the mixing and application of oil sprays. R. H. SMITH (*Citrus Leaves*, 9 (1929), No. 8, pp. 7, 34).—This is a summary of an address given at the Citrus Institute and Pest Control School held at the California Experiment Station.

Increasing the effectiveness of the nicotine insecticidal unit charge. E. R. MCGOVAN (*Jour. N. Y. Ent. Soc.*, 37 (1929), No. 4, pp. 513-531, fig. 1).—In this contribution from the New Jersey Experiment Stations, the author has found that sodium oleate soap, soap unit for soap unit, is more efficient in accomplishing reductions of interfacial and surface tensions than fish oil soap, and that either is more efficient for this purpose than any other substances with which the author has worked.

New solvents for the active principles of pyrethrum. W. A. GERSDORFF and W. M. DAVIDSON (*Indus. and Engin. Chem.*, 21 (1929), No. 12, pp. 1251-1253).—The authors have found that a number of solvents, some miscible with water and some immiscible, some flammable and some nonflammable, completely remove the active principle of pyrethrum for practical use against the green peach aphid. Many of these vehicles are suitable for application on plants as resistant as cabbage because they do not injure the foliage, whereas kerosene causes such severe injury that it is unsuitable. At 5 per cent concentrations all the extracts tested except xylene and amylene dichloride give effective control against this aphid without injury to cabbage.

[Report of work in entomology at the Arkansas Station] (*Arkansas Sta. Bul.* 246 (1929), pp. 50-53, fig. 1).—The great elm leaf beetle *Monocesta coryli* Say, which has not been very abundant in the past, is reported by W. J. Baerg to have appeared locally in such numbers in 1928 and 1929 that many red elm trees (*Ulmus fulva*), its favorite host, were stripped, and the American elm (*U. americana*) and various species of hawthorn (*Crataegus* sp.) were more or less severely injured. The adult beetles appeared from the last week in May until the first week in June, and after feeding from 20 to 30 days the females deposited eggs in yellow masses of from 20 to 80 eggs each on the under surface of the leaves. After an incubation period of from 15 to 16 days, the larvae hatched out and passed through three instars which required an average of 5, 8-9, and 12-13 days, respectively. The larvae began maturing the last week in July and entered the ground, where they spent the remainder of the summer, fall, and winter. Pupation began the last 10 days of April and continued until about May 20, the pupal period varying from 15 to 25 days with an average of 18 or 19 days.

Brief reference is made by D. Isely to the occurrence of the bean leaf beetle, three generations of which were reared in 1929. Factors affecting the boll weevil are also discussed.

It is pointed out by H. H. Schwardt that the saw-toothed grain beetle is a serious pest in rice mills of the State, where it infests polished rice and the rice by-products. Life history studies carried on in 1929 have shown that the pest is unable to develop to maturity in polished rice. The newly hatched larva fed on polished rice showed no evidence of growth and died within a

few days. Larvae fed on rice bran, rice polish, or ground brown rice grew rapidly and completed the larval period in as short a time as 11 days.

The status of economic entomology in Peru, G. N. Wolcott (*Bul. Ent. Research*, 20 (1929), No. 2, pp. 225-231).—An account by the former entomologist of the Peruvian Agricultural Experiment Station at Lima.

[Economic insects in Spain] (*Estac. Fitopat. Agr. Barcelona Pubs.* 1, 2. ed. (1929), pp. 13, figs. 4; 3, 4. ed. (1928), pp. 14, figs. 11; 4, 2. ed. (1928), pp. 20, figs. 10; 5 (1927), pp. 30, figs. 15; 6 (1927), pp. 68, figs. 15; 7 (1928), pp. 21, figs. 8; [Unnumb. Pub.], 2. ed. (1929), pp. 36, pls. 4).—Practical accounts are given of some of the more important insect pests in Spain, as follows: The Codling Moth, by J. Nonell Comas and A. de la Huerta; The Olive Fly, The Apple and Cherry Ermine Moths (*Hyponomeuta* spp.), and The Mediterranean Fruit Fly and the Pomace Fly, all by J. Nonell Comas; Insect Enemies of Growing and Stored Cereals, by J. Nonell Comas and A. Bertrán Olivella; The Hazel Weevil (*Balaninus nucum*), by J. Nonell Comas; and the Cochyliis, Endemis, Pyralis, and Altica Enemies of the Vine—Their Natural Enemies and Means of Control, by I. V. Claró and J. Nonell Comas.

[Report on entomology], I. B. P. EVANS (*Farming in So. Africa*, 4 (1929), No. 44, pp. 400-405).—This is a report on the occurrence of and work with the more important insects of the year in the Union of South Africa.

Report of the Government entomologist for the year 1927, [H. H. KING] (*Wellcome Trop. Research Labs., Ent. Sect. Bul.* 25 (1928), pp. 7).—A brief account of the occurrence of and control work with the more important insect enemies of the year in the Sudan (E. S. R., 58, p. 858).

List of publications on Indian entomology, 1928 (*Agr. Research Inst., Pusa, Bul.* 200 (1929), pp. 33).—This compilation is in continuation of that of the previous year (E. S. R., 61, p. 355).

Insects of Samoa and other Samoan terrestrial Arthropoda (*London: Brit. Mus. (Nat. Hist.)*, 1927, pt. 2, fasc. 1, pp. 45, figs. 32; pt. 3, fasc. 1, pp. 64, pls. 4, fig. 1, fasc. 2, pp. 65-116; pt. 4, fasc. 1, pp. 66, figs. 27; pt. 6, fasc. 1, pp. 21, figs. 13; pt. 7, fasc. 1, pp. 44, pl. 1, figs. 19; pt. 8, fasc. 1, pp. 27, pls. 2, figs. 18; 1928, pt. 1, fasc. 1, pp. 8; pt. 2 fasc. 2, pp. 47-80, figs. 38; pt. 3, fasc. 3, pp. 117-168, pl. 1, figs. 2; pt. 4, fasc. 2, pp. 67-174, pl. 1, figs. 39; pt. 5, fasc. 1, pp. 58, figs. 33; pt. 6, fasc. 2, pp. 23-108, figs. 24; pt. 7, fasc. 2, pp. 45-76, figs. 8, fasc. 3, pp. 77-116, pls. 2, figs. 35; 1927, maps 2).—The eight parts of this series are subdivided into fascicles, of which the following have been issued to July 28, 1928: I, Orthoptera and Dermaptera—fasc. 1, Dermaptera, by A. Borelli; II, Hemiptera—fasc. 1, Fulgoroidea by F. Muir (pp. 1-27), Psyllidae (Chermidae) by D. L. Crawford (pp. 29-33), and Coccidae, Aphididae, and Aleyrodidae by F. Laing (pp. 35-45); fasc. 2, Cercopidae by V. Lallemand (pp. 47-54), Cicadidae by J. G. Myers (pp. 55-65), and Aquatic and Semiaquatic Heteroptera by T. Esaki (pp. 67-80); III, Lepidoptera—fasc. 1, Butterflies of Samoa and Some Neighboring Island-Groups, by G. H. E. Hopkins; fasc. 2, Micro-Lepidoptera, by E. Meyrick; and fasc. 3, Geometridae, by L. B. Prout; IV, Coleoptera—fasc. 1, Carabidae by H. E. Andrewes (pp. 1-14), Dytiscidae by A. Zimmermann (pp. 15-19), Staphylinidae by M. Cameron (pp. 21-23), Hydrophilidae by A. d'Orchymont (pp. 29-34), and Clavicornia and Lamellicornia by G. J. Arrow (pp. 35-66); fasc. 2, Heteromera, Bostrychoidea, Malacodermata, and Buprestidae by K. G. Blair (pp. 67-109), Elateridae by R. H. van Zwaluwenberg (pp. 111-124), Melasidae (Eucnemidae) by E. Fleutiaux (pp. 125-134), Cerambycidae by C. Aurivillius (pp. 135-154), Brenthidae by R. Kleine (pp. 155-159), Anthribidae by K. Jordan (pp. 161-172), and Proterhinidae by R. C. L. Perkins (pp. 173, 174); V, Hymenoptera—fasc. 1, Apoidea, Sphecoidea, and Vespoidea by

R. C. L. Perkins and L. E. Cheesman (pp. 1-32), Larridae by F. X. Williams (pp. 33-39), and Formicidae (Fourmis) by F. Santschi (pp. 41-58); VI, Diptera—fasc. 1, Streblidae and Nycteribiidae by L. Falcoz (pp. 1-9), and Hippoboscidae by G. F. Ferris (pp. 10-21); fasc. 2, Nematocera by F. W. Edwards (pp. 23-102), and Cecidomyiinae (Gall Midges) by H. F. Barnes (pp. 103-108); VII, Other Orders of Insects—fasc. 1, Isoptera: Family Termitidae by G. F. Hill (pp. 1-18), and Odonata by F. C. Fraser (pp. 19-44); fasc. 2, Plecoptera (Mayflies) by R. J. Tillyard and J. A. Lestage (pp. 45-51), Siphonaptera by P. A. Buxton (pp. 53, 54), and Thysanoptera by R. S. Bagnall (pp. 55-76); fasc. 3, Mallophaga by J. Waterston (pp. 77-83), Anoplura by P. A. Buxton (pp. 85, 86), Trichoptera by M. E. Mosely (pp. 87, 88), Neuroptera by P. Esben-Petersen (pp. 89-108), and Apterygota by G. H. Carpenter (pp. 109-116); and VIII, Terrestrial Arthropoda Other Than Insects—fasc. 1, Isopoda Terrestria by H. G. Jackson (pp. 1-11), Scorpioneidea by P. A. Buxton (p. 13), Pseudoscorpiones by A. Kästner (pp. 15-24), and Acarina by S. Hirst (pp. 25-27).

Insects injurious to sunflower in Ukraine, N. S. DEKHTAREV (*Bul. Ent. Research*, 19 (1929), No. 4, pp. 411-419, figs. 5).—Notes are given on the more important enemies of the sunflower in Ukraine. Its cultivation is of particular importance in the eastern part, which suffers from drought, and where it constitutes the largest single crop.

The food of trout stream insects in Yellowstone National Park, R. A. MUTKOWSKI and G. M. SMITH (*Roosevelt Wild Life Ann. [Syracuse Univ.]*, 2 (1929), No. 2, pp. 241-263).—This detailed report, presented in large part in tabular form, is based upon joint investigations of the authors during the summer of 1921.

The control of Calotermes in living plants, F. P. JEPSON (*Ceylon Dept. Agr. Bul.* 86 (1929), pp. 11).—This is a report of observations made in the course of a visit to America in connection with termite control.

The locust invasion of Palestine during 1928, G. E. BODKIN (*Bul. Ent. Research*, 20 (1929), No. 2, pp. 123-139, pls. 3, figs. 3).—The author reports upon the invasion of *Schistocerca gregaria* Forsk. and methods of control thought likely to prove effective. A note describing and giving plans for a flame-projecting apparatus for use against locusts is appended.

The Sudan millet bug, Agonoscelis versicolor F., F. G. SAREL-WHITEFIELD (*Bul. Ent. Research*, 20 (1929), No. 2, pp. 209-224, pl. 1, figs. 16).—This is a report of studies of a pentatomid enemy of millet in the Sudan.

A new pest of rice in South India, P. N. KRISHNA AYYER (*Bul. Ent. Research*, 20 (1929), No. 2, pp. 173-178, fig. 1).—This reports an investigation made of the pentatomid bug *Tetradia histeroidea* Fab., a severe outbreak of which in South India in July, 1926, threatened the total destruction of the standing paddy crop.

Physomerus grossipes F. (Coreidae. Hemiptera-Heteroptera), a pest of Convolvulaceae and Leguminosae, N. C. E. MILLER (*Malayan Agr. Jour.*, 17 (1929), No. 11, pp. 405-420, figs. 8).—A report of studies of the anatomy, life history, and habits of a coreid bug that is a common pest of leguminous and convolvulaceous plants in Malaya.

Life history notes on some leafhoppers that occur on New Jersey cranberry bogs, C. S. BECKWITH and S. B. HUTTON (*Jour. N. Y. Ent. Soc.*, 37 (1929), No. 4, pp. 425-427).—In this contribution from the New Jersey Experiment Stations several leafhoppers are noted, including *Euscelis striatulus* Fall., *Platymetopius magdalenensis* Prov., *Thamnotettix smithi* Van Duzee, *Gypsona octolineata* var. *striata* Burm., the six-spotted leafhopper, *T. nigrofrons* Forbes, and several forms of less importance.

Cranberry false-blossom disease spread by a leafhopper, I. D. DOBROSKY (*Science*, 70 (1929), No. 1826, p. 635).—Observations and field experiments extending over a period of three summers are said to have given evidence that the false-blossom disease of cranberries is spread by *Euscelis striatulus* Fall. It is not known whether this leafhopper is the only insect that spreads the disease, although several other cranberry insects that were tested failed to transmit the virus.

The carrot psyllid (*Triozia viridula* Zett.), its biology and its distribution in Sweden [trans. title], O. LUNDBLAD (*Meddel. Centralanst. Försöksv. Jordbruksområdet [Sweden]*, No. 350 (1929), pp. 45, figs. 19; *Eng. abs.*, pp. 43, 44).—A report of a study made of an enemy of the carrot that is generally distributed over Sweden. It is presented in connection with a list of 21 references to the literature.

Notes on Porto Rican Homoptera, H. OSBORN (*Jour. Dept. Agr. Porto Rico*, 13 (1929), No. 3, pp. 81–112, fig. 1).—These notes are based mainly on collections made by the author on a trip to Porto Rico in the winter of 1928–29.

Studies on aphid transmission of plant viruses, I. A. HOGGAN (*Jour. Bact.*, 19 (1930), No. 1, pp. 21, 22).—This is the author's abstract of a contribution presented at the thirty-first annual meeting of the Society of American Bacteriologists, held from December 30, 1929, to January 1, 1930, at Ames, Iowa.

Greenhouse trials have now demonstrated that the two aphids *Myzus pseudo-solan* Theob. and *Macrosiphum solanifolii* Ashm. are capable of transmitting the specific virus of ordinary tobacco mosaic from tomato to various solanaceous hosts, although these aphids are apparently incapable of transmitting the same virus from tobacco. On the other hand, they will readily transmit the cucumber mosaic virus from both tobacco and tomato, as will also a third species, *Myzus circumflexus* Buckt. This third species also appears unable to transmit the virus of ordinary tobacco mosaic from tobacco, in this respect resembling the green peach aphid.

A contribution to the life history of the lac insect, *Laccifer* (*Tachardia*) *lacc* (*Coccidae*), P. S. NEGI (*Bul. Ent. Research*, 19 (1929), No. 4, pp. 327–342, pl. 1, figs. 6).—This is a contribution from the Lac Research Institute, at Namkum, India.

The giant moth borer of sugar-cane (*Castnia licus* Drury), H. M. SKINNER (*Trop. Agr. [Trinidad]*, Sup., Jan., 1930, pp. 8, pl. 1, figs. 2).—An account of a pest that occurs in Trinidad, British Guiana, and some other parts of South America, where its depredations may be very severe.

***Castniomera humboldti* (Boisduval)**, a pest of bananas, G. SALT (*Bul. Ent. Research*, 20 (1929), No. 2, pp. 187–193, pl. 1, fig. 1).—The castniid moth *C. humboldti*, which occurs in banana-growing districts of Central America and northern South America, is reported upon. The larvae bore extensively in the base of banana pseudostems.

Spraying costs in codling moth control, R. T. M. PESCOTT (*Jour. Dept. Agr. Victoria*, 27 (1929), No. 11, pp. 672, 673).—In two years' experimental work at Harcourt when arsenate of lead was applied in five or six sprays 36 per cent of the fruit was infested with codling moth, but when arsenate of lead was applied in two calyx sprays followed by three white oil sprays 12 per cent of the fruit was infested, an advantage of 24 per cent for the oil sprays.

The codling moth (*Cydia pomonella* L.): Control experiments and life history observations at Bathurst, New South Wales, 1926–27, S. L. ALLEN (N. S. Wales Dept. Agr., Sci. Bul. 31 (1928), pp. 36, figs. 11).—The first part of this bulletin deals with control experiments (pp. 5–9) and the second part with life history and miscellaneous observations (pp. 10–36).

The oriental fruit moth, C. O. EDDY, M. H. BRUNSON, and W. H. CLARKE (*South Carolina Sta. Circ. 38* (1930), pp. 31, figs. 15).—The depredation caused in South Carolina by *Laspeyresia molesta* Busck has led to the compilation of data from publications of the U. S. Department of Agriculture and the State experiment stations. In a peach orchard near Greenville, S. C., in which Elberta was the only variety grown, a total loss of 18.1 per cent of the fruit was caused in 1929. In an orchard at Greer the loss by wormy fruit, almost entirely due to this fruit moth, represented 25 per cent of the crop. The loss caused by the insect in sections farther to the east was generally much less, the damage in Chesterfield County not being noticeably greater than during the past few years. During the latter part of the season of 1929, the fruits of 13 late varieties of peaches were examined at Clemson College, an average fruit infestation of 32.53 per cent having occurred during the period from August 8 to September 20. The maximum and minimum infestations during the same period were 47.5 and 13.3 per cent, respectively. A heavier infestation of later peaches has also been noted by other investigators.

It was considered advisable that cultural means of control be adopted everywhere in South Carolina.

The blossom worm, a cranberry pest, C. S. BECKWITH (*Jour. N. Y. Ent. Soc.*, 37 (1929), No. 4, pp. 409-416, fig. 1).—This contribution from the New Jersey Experiment Stations reports briefly upon observations of *Epiglaea apiata* Grt., a serious cranberry pest in New Jersey. This lepidopteran is of economic importance more because of the severity of its attacks in isolated cases than because it is present on all bogs every year. Its work is done suddenly, and complete destruction of the crop may follow an infestation. Bogs under observation have apparently lost all of their bloom in one night, although the insects had probably been working unnoticed for several nights and the cutting off of the bloom on the last night was so obvious that it seemed to have gone all at once. After as severe an infestation at this, a control measure is usually applied and the insect does not appear again for several years.

The injury, which consists chiefly in the cutting off of the flowers, the entire crop often being ruined in this way, is easily controlled by flooding or spraying if the infestation is promptly located. Insect parasites, including *Sugaritis orylus* Cress., *Euplectrus bicolor* (Swed.), *Rogas* sp., and a tachinid, are said to be very numerous and to keep the pest from multiplying greatly under ordinary conditions.

Pathology and entomology: A new avocado moth (Lepidoptera, Fm. Tortricidae), A. BUSCK (*Calif. Avocado Assoc. Yearbook*, 1929, pp. 127-129, fig. 1).—This description of *Amorbia essigana* n. sp., which attacks the avocado in California, has been noted from another source (E. S. R., 61, p. 853).

Recovery from parasitism, C. C. BROOKS (*Nature* [London], 125 (1930), No. 3140, pp. 14, 15).—This contribution is based upon studies of the biology and forest relations of the pine shoot moth (*Evectria buoliana* Schiff.), a common lepidopterous pest of young Scots pine in Europe which has become of increasing prevalence in the numerous young pine plantations in East Anglia, England. In a study of caterpillars collected from different areas and reared, those that came from areas in which the percentage of internal parasitism of the caterpillars was high yielded some fertile moths that were much smaller than the supposed minimum for the species. From others which came from areas where the percentage of parasitism was low such small moths were exceedingly rare. It is thought that the occurrence of these small moths may be connected in some way with the high percentage of internal parasitism, and that they may possibly be the results of a recovery from parasitism.

The corn borer, *Pyrausta nubilalis* Hübner (Pyralidae, Pyraustinae, Lepidoptera), C. T. BULIGAN (*Philippine Agr.*, 17 (1929), No. 8, pp. 397-450, pls. 8).—This is a report of studies of the European corn borer in the Philippines, where it is one of the most important insect enemies of corn, over 50 per cent of the crop being destroyed in some localities. The life history and habits of the pest are reported upon at length and technical descriptions given of its several stages. There are said to be at least nine generations during the year in the islands. Its natural enemies studied include nine species of hymenopterous parasites and five insect predators. During the course of the present work only corn and sorghum were found attacked, and sorghum was free from infestation when corn was grown in large quantities. This fact indicates that corn is preferred to sorghum as host.

A 9-page list of references to the literature is included.

Height and silking as factors influencing European corn borer population, C. R. NEISWANDER and L. L. HUBER (*Ann. Ent. Soc. Amer.*, 22 (1929), No. 3, pp. 527-532, figs. 6).—This is a contribution from the Ohio Experiment Station.

How to control the pale western cutworm, W. B. MABEE (*Mont. Agr. Col. Ext. Bul.* 100 (1929), pp. 11, figs. 6).—A practical account of control measures for this pest.

Experimental researches on the metamorphosis of *Galleria mellonella* and general considerations on the postembryonic development of insects, with new histological observations [trans. title], T. YUNG-TAI (*Bul. Biol. France et Belg.*, 63 (1929), No. 3, pp. 350-376).—This is a report of studies presented in connection with 24 references to the literature.

Notes on the natural enemies of the iris borer, *Macronoctua onusta* Grote (Lepidoptera), E. P. BREAKEY (*Ann. Ent. Soc. Amer.*, 22 (1929), No. 3, pp. 459-464).—This is a report of observations made in Wisconsin during an unusually heavy infestation of the iris borer extending over several years. There was an indicated parasitism from Diptera in 1928 of 10 per cent. The following species have been reared from iris borer caterpillars: *Muscina stabulans* Fall., *M. assimilis* Fall., *Myiospila mediatubunda* Fab., *Sarcophaga cimbicis* Tns., *S. latisterna* Park., and *Masicera senilis* Mg. In the number of individuals appearing, *M. stabulans* ranked first and *M. senilis* second. The host had apparently been destroyed in each instance just before pupation, the puparium of the fly lying in the immediate vicinity of the pupal chamber.

The leaf feeding activities of the young caterpillars may contribute to their being parasitized by larvae of *M. senilis*. The filthy conditions under which the caterpillars live obviously contribute to their being parasitized by larvae with habits such as those of *M. stabulans*. The activities of the caterpillars expose them to the attacks of such parasitic Diptera as the sarcophagids. No Hymenoptera issued from the caterpillars under observation. Predator enemies of the iris borer include the larval and adult stages of *Calosoma*, of which *C. calidum* Fab. was the most common; the robin, *Planesticus migratorius migratorius* L.; and insectivorous rodents.

The life history of *Aedes flavescens* Müller: A contribution to the biology of mosquitoes of the Canadian prairies, E. HEARLE (*Roy. Soc. Canada, Proc. and Trans.*, 3, ser., 23 (1929), Sect. V, pp. 85-102, pls. 6).—Descriptions are given of the several stages of *A. flavescens*, including four larval instars.

Studies on yellow fever in South America, IV, V, N. C. DAVIS and R. C. SHANNON (*Jour. Expt. Med.*, 50 (1929), No. 6, pp. 793-801, 803-808).—These two contributions are as follows:

IV. *Transmission experiments with Aedes aegypti*.—"Batches of *A. (Stegomyia) aegypti* which had fed on monkeys in the early febrile stage of yellow fever and which had subsequently passed the usually accepted extrinsic incuba-

tion period for the virus failed to transmit the disease to normal monkeys in approximately 50 per cent of the experiments. During the same time over 80 per cent of blood transfers were successful. The monkeys which failed to show fever following mosquito bites later proved resistant to the inoculation of blood or tissues containing virus. The incubation, or afebrile, period in monkeys following the bites of infected mosquitoes varied from less than 24 hours to 15 days. It averaged somewhat longer in nonfatal than in fatal infections."

V. *Transmission experiments with certain species of Culex and Aedes*.—"Yellow fever virus has been transmitted from monkey to monkey both by the bites of *A. (Ochlerotatus) scapularis* which fed upon monkeys infected with yellow fever and by the injection of the ground up bodies of such mosquitoes. A fatal infection has been obtained by the injection of the ground up bodies of *A. (Ochlerotatus) serratus*, which had previously fed on an infected monkey, and a mild infection has been secured by the similar injection of *A. (Taeniorhynchus) taeniorhynchus*. No definite infection has been secured either by the bites or by the injection of *C. quinquefasciatus* (*C. fatigans*). However, some of the experimental animals bitten by this species have been relatively immune following inoculations of blood or tissues containing virus."

The filtrability of yellow fever virus as existing in the mosquito, W. A. SAWYER and M. FROBISHER, JR. (*Jour. Expt. Med.*, 50 (1929), No. 6, pp. 713-718).—"The virus of yellow fever as it exists in *Aedes aegypti* mosquitoes, both in their so-called infective stage and in the intermediate condition termed the 'incubation period,' is capable of passing through Berkefeld N filters when suspended in normal monkey serum, although earlier investigators have shown that the virus from infective mosquitoes will not do so when suspended in physiological salt solution. The virus of yellow fever as it exists in mosquitoes behaves with regard to filtration through Berkefeld N filters as does the virus in the blood of infective monkeys."

Possibility of hereditary transmission of yellow fever virus by *Aedes aegypti* (Linn.), C. B. PHILIP (*Jour. Expt. Med.*, 50 (1929), No. 6, pp. 703-708).—Attempts to obtain passage of yellow fever virus from one generation to the next in the yellow-fever mosquito were unsuccessful. Subcutaneous injections at varying intervals of a saline emulsion of 200 eggs laid by an infective lot of mosquitoes produced no reaction in six normal *Macacus rhesus* monkeys. Negative results were also obtained in five biting and two injection experiments with progeny of the same infective lot of mosquitoes in which seven normal monkeys were used.

The author concludes that under the conditions in which the experiments reported were conducted hereditary transmission of yellow fever by the yellow-fever mosquito is improbable. Variations in age and in number of blood meals of parent and offspring mosquitoes had no effect in achieving passage of the virus from one stage of the insect to another.

Effects on mosquito larvae of a Queensland Nitella, E. W. I. BURNETT (*Roy. Soc. Queensland, Proc.*, 58 (1926), pp. 59-61).—The author has found *N. phauloteles* to be highly effective against mosquito larvae.

The utilization of aquatic plants as aids in mosquito control, R. MATHEWSON (*Amer. Nat.*, 64 (1930), No. 690, pp. 56-86, figs. 12).—This account is based upon work earlier accounts of which have been noted (*E. S. R.*, 62, p. 249).

Ox warble fly: Report on the demonstration and experiments carried out in Worcestershire in 1928 and 1929, R. C. GAUT and C. L. WALTON (*Worcester: Worcestershire Co. Council, Dept. Agr. Ed.*, 1929, pp. 26).—In this report of work under way it is pointed out that the choice of the killing agent for the ox warble lies between ointments and liquids, other methods

not being advised. The ox warble ointment is considered an efficient killing agent which can be employed for cattle that are tied up, but it must be forced into every warble hole and properly plugged. It is said that a 100 per cent kill can be obtained if this is properly done. Derris-soap-wash, consisting of Polvo 1 lb., soft soap 0.25 lb., and water 1 gal., has also given pronounced success. For complete extermination by this wash the cattle must be examined and dressed, if warbles are present, four times during the season at intervals not exceeding four weeks.

On the oviposition of *Gastrophilus pecorum* [trans. title], G. DINULESCU (*Ann. Parasitol. Humane et Compar.*, 7 (1929), No. 4, pp. 287-289, figs. 2).—The author is led to conclude that *G. pecorum* deposits its eggs on objects in the vicinity of but not on the equines themselves.

Preliminary note on some phorids that parasitize leaf-cutting ants of the genera *Atta* and *Acromyrmex* [trans. title], F. T. BORGMUELER (*Bol. Biol. [Sao Paulo]*, No. 14 (1928), pp. 119-126, figs. 2).—Sixteen species of phorids representing six genera were observed to be associated with the leaf-cutting ants, important pests in Brazil. All but one of these phorids are said to be definite parasites, attacking the ant by inserting their eggs between the abdominal segments. A genus is erected, and 10 species are described as new.

The sheep blowfly: Cause, effect, prevention, and treatment of cutaneous myiasis (*Agr. Gaz. N. S. Wales*, 39 (1928), Nos. 11, pp. 795-807, fig. 1; 12, pp. 927-937, figs. 3).—This is a compilation by the External Parasites of Sheep Committee.

A new pest threatens Australia, A. M. B. (*Sci. Prog. [London]*, 24 (1930), No. 95, pp. 509, 510).—This refers to a little-known buffalo fly, *Lyperosia exigua*, which is rapidly spreading through the chief cattle-rearing areas and making it impossible to raise fat cattle for slaughter during certain seasons. It is said to have entered northern Australia from Java, where cattle appear to be less sensitive to its ravages, and is now spreading southward in Australia. It has also entered Queensland from the east and already reached west. Wyndham is extremely badly infested, and recent reports state that it has even gone as far south as Fremantle with the cattle boats.

The olive fly (*Dacus oleae* Rossi), F. E. TODD (*Calif. Dept. Agr. Mo. Bul.*, 18 (1929), No. 10, pp. 526-533, figs. 4).—This account of the olive fruit fly is based upon observations made by the author in Spain during 1925 and 1926.

Queensland fruit flies (Trypetidae), Series I, H. TAYLOR (*Roy. Soc. Queensland, Proc.*, 38 (1926), pp. 176-224, pls. 5).—This account of the fruit flies of Queensland includes descriptions of 12 new species.

Investigations of the life history and control of *Hylemyia antiqua* Meigen, I, II [trans. title], A. KÄSTNER (*Ztschr. Pflanzenkrank. u. Pflanzenschutz*, 39 (1929), Nos. 2, pp. 49-97, figs. 3; 3, pp. 122-139, fig. 1; *Ztschr. Wiss. Biol., Abt. A, Ztschr. Morph. u. Ökol. Tiere*, 15 (1929), No. 3, pp. 363-422, figs. 28).—The first part of this account deals with means of combating the adult in the spring (pp. 49-97, 122-139), and the second part deals with its morphology and biology, including its geographical distribution (pp. 363-422). Each part includes a list of references to the literature.

Third report on a rat-flea survey of the city of San Juan, Porto Rico, A. L. CARRIÓN (*Porto Rico Jour. Pub. Health and Trop. Med.*, 5 (1929), No. 2, pp. 158-166, figs. 7).—In this further report (E. S. R., 59, p. 480) of work in which 249 live rats were trapped in San Juan, fleas were found in 68 per cent of those captured. A total of 1,970 of these parasites was collected, their concentration appearing highest at the docks. The index reached 7.9 fleas per rat, and the cheopis index was 7.7.

Control of the Mexican bean beetle for 1930. C. O. EDDY and W. H. CLARKE (*South Carolina Sta. Circ.* 39 (1930) pp. 16. figs. 5).—The Mexican bean beetle, which has been under observation by the station since it became one of the major pests of the State soon after it was first observed in Oconee and Pickens Counties in 1921 (E. S. R., 61, p. 662; 62, p. 650), caused its greatest damage in the State during the early part of the season of 1929. Under the weather conditions of that season magnesium arsenate was the only arsenical that was effective in controlling the insect and harmless to the plant. Certain brands of calcium arsenate that had been satisfactory during dry seasons burned bean plants severely, and some brands that had given satisfactory service were no longer procurable.

In the present circular, following a brief account of the distribution of the insect, an account is given of the seasonal history and a summary of preventive and control measures. The application of poisons should be made at intervals of from 3 to 7 days as soon as the eggs become numerous or as soon as the adults appear in sufficient numbers to do noticeable damage. Applications should be discontinued while the plants are in the bearing stage unless provision is made for rinsing the green beans twice in clear water before selling or cooking. Magnesium arsenate can be used as a spray at the rate of 1 lb. to 50 gal. of water or as a dust at the rate of 1 lb. to 3 lbs. of lime hydrate.

Investigations of *Niptus hololeucus* Fald.—I, Morphology and biology [trans. title]. R. BRAUNE (*Ztschr. Wiss. Biol., Abt. A. Ztschr. Morph. u. Ökol. Tiere*, 16 (1929), No. 1-2, pp. 234-370, figs. 56).—This is an extended account of studies of the golden spider beetle (*N. hololeucus*), a household and stored-product pest of general occurrence throughout Europe. (See also E. S. R., 62, p. 250.) Several isolated records of its occurrence in the United States are reported by Parker and Mabey, who found it to occur in Montana (E. S. R., 61, p. 153).

The account includes a list of 61 references to the literature.

Sweet potato sawfly. P. J. CHAPMAN and G. E. GOULD (*Virginia Truck Sta. Bul.* 68 (1929), pp. 767-786, figs. 4).—The native insect *Sterictiphora cellularis*, known as the sweetpotato sawfly, which occasionally causes damage to sweetpotatoes through the feeding of the larvae upon the leaves, was a source of serious damage to a few potato fields in Princess Anne and Norfolk Counties, Va., and Currituck County, N. C., in 1928 and 1929. In a brief discussion of its synonymy, included in the account, S. A. Rohwer shows that *Schizocerus ebenus* and *S. privatus* of Norton are synonyms of *Sterictiphora cellularis*. The authors find that in Virginia three broods may develop in a season, the first brood of larvae appearing about July 1. Its eggs are found within blister-like swellings in the leaves. The larvae when full grown construct brownish cocoons at or just below the soil surface and transform to pupae.

The natural enemies of the insect include the muscoid parasite *Schizocero-phaga leibyi* Towns, which destroyed a large percentage of the larvae in Virginia in 1929. Artificial control can be accomplished by the application of a spray consisting of arsenate of lead 1.5 lbs. to 50 gal. of water, or calcium arsenate 1 lb., hydrated lime 2 lbs., and 50 gal. of water, or of a dust consisting of 1 part of calcium arsenate and from 7 to 9 parts of hydrated lime.

A list of 17 references to the literature is included.

Studies on the rush saw-fly.—III, Relation of temperature to the development of the rush saw-fly. C. HARUKAWA and S. KONDO (*Ber. Ōhara Inst. Landw. Forsch.*, 4 (1929), No 2, pp. 181-198, figs. 6).—This is a report of studies conducted in continuation of those previously noted (E. S. R., 62, p. 159).

On the value of parasitic Hymenoptera in the control of noxious insects [trans. title], N. F. MEYER (N. T. MEYER) (*Izv. Gosud. Inst. Opytn. Agron.* (Ann.

State Inst. Ezpt. Agron. [Leningrad]), 7 (1929), No. 3-4, pp. 399-404, figs. 2).—This discussion includes tables showing the host relations of 23 parasites of *Euxoa segetum* Schiff. and 22 parasites of the ermine moth.

New species of Ichneumonon-flies and taxonomic notes, R. A. CUSHMAN (*U. S. Natl. Mus. Proc.*, 76 (1929), Art. 25, pp. 18).—Among the new species here described that are important as parasites of economic insects are the following: *Chromocryptus mesorufus*, reared from either *Anastrepha ludens* Loew or *A. striata* Schiner in the vicinity of Cuernavaca, Morelos, Mexico; *Pristomerus baumhoferi*, reared from *Rhyacionia frustrana* var. *bushnelli* Busck in Halsey, Nebr.; *Cremastus carpocapsae*, reared from the codling moth in Lawrence County, Ohio; *C. rhyacioniae*, reared from *R. frustrana* var. *bushnelli* in Pactola, S. Dak.; and *Microbracon lendicivorus*, reared from midge maggots on *Ficus nota* Blanco in Los Banos, Luzon, P. I. A new genus, *Pycnaulacus*, of the family Aulacidae, is erected; the generic name *Hymenderleinia* is proposed for *Enderleinia*; and nine additional species are described as new.

Further notes on *Alysia manducator* and other parasites (Hym.) of muscoid flies, J. G. MYERS (*Bul. Ent. Research*, 19 (1929), No. 4, pp. 357-360).—The author reports upon a braconid parasite, *A. manducator* (E. S. R., 60, p. 656), reared in large numbers in the summers of 1927 and 1928 in England for shipment to Australasia as a measure against the sheep maggot. Notes are also presented on *Atractodes gravidus* Grav., *Figites striolatus* Hart., and *Mormoniella vitripennis* Walk.

Alysia manducator Pz., an introduced parasite of the sheep blowfly maggot, W. L. MORGAN (*Agr. Gaz. N. S. Wales*, 40 (1929), No. 11, pp. 818-829, figs. 3).—Of the seven hymenopterous internal parasites of the sheep blowfly in Australia reported in 1928 (see above), *Mormoniella brevicornis* tested on a large scale by the distribution of millions of living parasites has exercised no appreciable control over it. The European braconid *A. manducator*, first introduced from Europe into Australia in January and March, 1925, was again introduced in January, 1928.

The morphology and biology of *Eulimneria crassifemur*, an important parasite of the European corn borer, W. R. THOMPSON and H. L. PARKER (*Jour. Agr. Research [U. S.]*, 40 (1930), No. 4, pp. 321-345, figs. 7).—*E. crassifemur* is an important hymenopterous parasite of the larva of the European corn borer in Europe, which with other parasites has been under observation in France since 1919. Since then shipments of it to the United States have been made in varying quantities each year.

In the present account the authors report upon the results of studies of its biology and habits, including descriptions and illustrations of its immature stages. Eggs numbering as many as 300 may be deposited by a single female in the body cavity of the young host larva. Upon hatching out the larva of this parasite lives free in the host, absorbing the internal organs, and upon reaching maturity emerges from the old borer skin and spins its cocoon in the host tunnel. Development proceeds slowly during hibernation. Generally there is a single generation each year, the adults from the overwintering cocoons emerging from March to June and ovipositing in the earliest appearing corn borer larvae in July or August. The larval growth takes place in the summer, and the overwintering cocoons are spun in September or October, there appearing to be no intermediate host. This parasite is found in the borer in both corn and *Artemisia*, the maximum parasitism of the host recorded in Europe being 27 per cent.

A list of 19 references to the literature cited is included.

On three new chalcidoid parasites of *Platyedra*, C. FERRIERE (*Bul. Ent. Research*, 20 (1929), No. 3, pp. 255-259, figs. 3).—*Brachymeria fijiensis* n. sp. from the Fiji Islands and *Elasmus johnstoni* n. sp. from the British Sudan and India are described from material obtained or reared from the pink boll-worm. *Eurytoma braconidis* n. sp. from Uganda, Tanganyika Territory, and British Sudan appears to be a hyperparasite living on braconid parasites.

The Encyrtinae of Japan, T. ISHII (*Bul. Imp. Agr. Expt. Sta. Japan*, 3 (1928), No. 2, pp. 79-160, figs. 57).—The author presents descriptions of 73 species of Encyrtinae, representing 37 genera, known to occur in Japan, of which 41 are recorded for the first time. Of these 34 are described as new to science. Four genera are erected. A bibliography of three pages is included.

Aphelinus mali and its travels, L. O. HOWARD (*Ann. Ent. Soc. Amer.*, 22 (1929), No. 3, pp. 341-368).—A historical account of the establishment of an important North American parasite of the woolly apple aphid in many parts of the world, into which it has been carried during the past nine years.

On the bionomics of a primary parasite and of two hyperparasites of the geranium aphid, G. H. GRISWOLD (*Ann. Ent. Soc. Amer.*, 22 (1929), No. 3, pp. 438-452, pls. 3, figs. 3).—The author here deals with *Aphelinus jucundus* Gahan, an internal primary parasite; *Aphidencyrthus inquisitor* (Howard), an internal secondary parasite; and *Asaphes americana* Gir., both an external secondary parasite and an external tertiary parasite. The egg, larval, and pupal stages of all three chalcids are spent within an aphid which is the true host of the *Aphelinus* only. As they differ in every phase of their development, no trouble was experienced in recognizing each species no matter in what stage it was found.

The mound-building ant, *Formica exsectoides* F., associated with tree-hoppers, E. A. ANDREWS (*Ann. Ent. Soc. Amer.*, 22 (1929), No. 3, pp. 369-391, figs. 5).—The author finds that *F. exsectoides* obtains food from dead and living insects and from honeydew that in the region studied near Baltimore, Md., is excreted not only by aphids but by coccids and by membracids.

The Sphegidae of South Africa, XI-XIV, G. ARNOLD (*Ann. Transvaal Mus.*, 12 (1928), No. 4, pp. 338-375, figs. 20; 13 (1929), No. 4, pp. 217-418, pls. 2, figs. 153).—These parts of the author's monograph of wasps of the family Sphegidae are in continuation of those previously noted (*E. S. R.*, 59, p. 562).

Neoplectana glaseri n. g., n. sp. (Oxyuridae), a new nemic parasite of the Japanese beetle (*Popillia japonica* Newm.), G. STEINER (*Jour. Wash. Acad. Sci.*, 19 (1929), No. 19, pp. 436-440, fig. 1).—A nematode that parasitizes the larvae of the Japanese beetle in New Jersey has been found to represent a new genus and species and is here described as *N. glaseri*. It is said to be the first time that a nematode has been observed parasitizing the Japanese beetle, and it is thought by the author to be a native parasite which has found the immigrant beetle a favorable host.

A nematode parasite of the Japanese beetle (*Popillia japonica* Newm.), R. W. GLASER (*Science*, 71 (1930), No. 1827, pp. 16, 17).—Observations on the new nematode parasite of the Japanese beetle grub noted above showed that it parasitized grubs in Haddonfield and Pitman, N. J., in August and September, and it is said to be ideally adapted as a parasite of this pest since the host spends most of its long life cycle in the ground. While the pest apparently still occurs locally, it possesses great reproductive and lethal capacities and thus might prove a valuable adjunct if distributed throughout the territory infested with the Japanese beetle.

ANIMAL PRODUCTION

The live stock industry and its development, J. S. GORDON (*Brit. Assoc. Adv. Sci. Rpt.*, 96 (1928), pp. 213-236).—In this address before the agricultural section of the British Association, the president of the section outlines trends of importance to agriculture and suggests methods for adjustments to meet these trends. The value of livestock and livestock products as compared with the entire value of agricultural produce in England and her possessions are pointed out, together with the index figures of prices of livestock for the period 1922-1926. Changes in marketing practices, particularly of cattle, are shown and some of the reasons for these changes discussed.

The improvement of commercial cattle is indicated as the most important adjustment facing the industry at this time, and for such improvement the increased use of pedigreed sires, the elimination of scrub bulls, and government inspection in grading and marketing livestock products are advocated.

The scientific basis of rationing animals, T. B. WOOD and J. W. CAPSTICK (*Jour. Agr. Sci. [England]*, 18 (1928), No. 3, pp. 486-495).—This is a discussion of the fundamental principles upon which a method of computing rations (E. S. R., 58, p. 562) was based. To justify the method, the results already achieved by its use have been collected and are discussed in this paper, together with the general applicability of the method and the possibility of extending its use in many directions.

The growth of cheaper winter food for live stock, LORD CLINTON ET AL. (*Rothamsted Expt. Sta., Harpenden, Rothamsted Confs.*, No. 10 (1930), pp. 56).—This report of a conference held at Rothamsted, England, November 15, 1929, includes the following papers: Introduction, by E. J. Russell (pp. 5-7); The Growth of Winter Food for Live Stock, by J. G. Stewart (pp. 9-11); The New Zealand Solution of the Problem, by H. E. Annett (pp. 12-17); The Growth of Winter Food for Live Stock, by W. Brunton (pp. 18-23); The Growth of Cheaper Winter Food for Dairy Cows, by R. Stallard (pp. 23-29); Growing of Fodder Roots in Denmark, by H. Faber (pp. 29-33); Winter Feeding of a Dairy Herd on a Light-Land Essex Farm, by W. O. Watt (pp. 34-37); The Growth of Cheaper Winter Food for Live Stock, by J. R. Keeble (pp. 37-41); The Growth of Winter Food for Cattle, by T. C. Ward (pp. 42-46); and The Growth of Crops for Dairy Cattle, by W. A. C. Carr (pp. 46-52).

Quantitative relations of the dry matter of the food consumed, the heat production, the gaseous outgo, and the insensible loss in body weight of cattle, M. KRISS (*Jour. Agr. Research [U. S.]*, 40 (1930), No. 3, pp. 283-295, figs. 5).—The results of a biometric study of relations between values representing the feed consumption, the production of heat, carbon dioxide, water vapor, and methane, and the insensible loss in body weights of cattle are published in this paper from the Pennsylvania Institute of Animal Nutrition. Two series of data were analyzed, the first derived from 74 experimental periods, including data for insensible loss, heat production, and dry matter of feed, on planes of nutrition varying between about half maintenance and 3 times maintenance, and the second from 131 experimental periods, including data for heat, the production of carbon dioxide, methane, and water vapor, and for the dry matter of the feed, on the same planes of nutrition as the first series.

Correlation coefficients between the dry matter of feed and the following factors were found: Insensible loss 0.818 ± 0.026 , carbon dioxide 0.938 ± 0.007 , methane (all rations) 0.987 ± 0.007 , methane (roughages) 0.942 ± 0.01 , methane (mixed rations) 0.963 ± 0.006 , water vapor 0.762 ± 0.025 , heat production (74 periods) 0.936 ± 0.01 , heat production (131 periods) 0.883 ± 0.013 , and between insensible loss and heat production 0.847 ± 0.022 . between carbon dioxide and

heat production 0.967 ± 0.004 , and between water vapor and heat production 0.8 ± 0.021 .

By means of regression equations, the computed values were compared with values which had been directly determined, and the following average percentage differences obtained: Carbon dioxide computed from dry matter of feed, 4.7 per cent; methane computed from dry matter of feed, 10.6 per cent; water vapor computed from dry matter of feed, 14.9 per cent; heat production computed from insensible loss, 7.9 per cent; heat production computed from dry matter of feed, 4.9 per cent; and heat production computed from carbon dioxide, 2.9 per cent.

Based on these results, it was concluded that for practical purposes the dry matter of the feed consumed was a better basis for predicting the heat production of cattle than was the insensible loss in body weight.

The insensible loss in body weight of cattle, M. KRISS (*Jour. Agr. Research [U. S.]*, 40 (1930), No. 3, pp. 271-281).—Based on the data obtained at the Pennsylvania Institute of Animal Nutrition from 77 respiration calorimeter experiments, varying in length from 53 to 111 hours, and from 71 digestion trials of from 5 to 14 days' duration, at planes of nutrition varying from fast to about 3 times the maintenance requirement, the insensible loss of cattle was computed. The computations in all experiments were based on the live weight of the animals, the weights of the feed and water consumed, and the weights of excreta voided. In some experiments the results were checked by a computation based on the respiratory products as measured in the calorimeter. The two methods of determining the insensible loss agreed quite closely.

The lowest observed insensible loss in the calorimeter experiments was 2 kg. per day and the highest 17.8 kg. per day. The lowest computed value, based on respiratory products, was 2 kg. per day and the highest 16.7 kg. per day. These variations were related to the differences in planes of nutrition and size of animals. While a comparison of the average daily insensible loss obtained in the digestion stall with that obtained in the calorimeter shows that the temperature of the environment exerts a definite influence on this loss, it was found that this influence is either not pronounced or is modified by other conditions of environment, such as movement of air and relative humidity. The results also indicate that the hair coat influences markedly the insensible loss.

Studies in mineral metabolism, III-IX (*Jour. Agr. Sci. [England]*, 18 (1928), No. 3, pp. 369-405).—This series of studies by the Department of Agriculture, Union of South Africa, has been continued (E. S. R., 58, p. 563).

III. Breeding of cattle on phosphorus deficient pasture, A. Theiler, H. H. Green, and P. J. du Toit (pp. 369-371).—The scrub herd used in the previous work was culled, and the remaining cows divided into 4 lots of 50 head each and bred to selected bulls of the following breeds: Africander, Sussex, Friesland, and Red Poll. Each lot was again divided, and one division was fed a supplement of bone meal, while the remainder as controls were confined to veld grazing.

Mortality records showed that deaths due to lamziekte (botulism of bovines), plant poisoning, and "poverty" were more numerous in the control cattle than in the lots receiving minerals, only 47 per cent of the control cattle surviving. In the lot receiving minerals, an 80 per cent calf crop was obtained, while only 51 per cent of the controls calved. The calves from cows supplied with bone meal and themselves receiving bone meal showed a marked superiority over the control calves. The results indicate the value of bone meal for reducing mortality, increasing fertility, and obtaining better development of calves.

IV. *Determination of phosphorus compounds in blood by dry combustion*, H. H. Green (pp. 372-375).—A new method, combining speed and convenience, for determining the phosphorus compounds in blood by dry combustion is described in this article.

V. *Composition of bovine blood on phosphorus deficient pasture*, A. I. Malan, H. H. Green, and P. J. du Toit (pp. 376-383).—A study of the blood of animals on phosphorus-deficient pastures showed a characteristic low inorganic phosphorus content with a correlated reduction in total phosphorus. Two-year-old heifers fed bone meal from weaning time had a normal inorganic phosphorus fraction of 5 mg. per 100 cc. of blood, while control heifers receiving no bone meal had 2.3 mg. Control cows had blood phosphorus contents as low as 1 mg. or even lower, but the calves of these cows were normal as long as the milk supply was adequate and showed reduced inorganic phosphorus only when aphosphorosis of the mother was acute. As a whole, low inorganic phosphorus of the blood was associated with poor condition of the animal. A rapid colorimetric method for determination of inorganic phosphorus of blood obtained from the jugular vein, which can be used to detect less pronounced deficiencies of phosphorus, is described.

VI. *Comparison of the blood of cow and calf in respect to mineral constituents*, H. H. Green and E. H. Macaskill (pp. 384-390).—In a comparison of the blood of a cow and calf, it was found that the total phosphorus in the blood of a newborn calf may be more than twice that of the mother. The phosphorus content of the calf's blood appears to rise for the first few days and then falls steadily, so that at about 10 weeks of age the difference may be only 15 per cent. After weaning there was no noticeable difference between the blood of the mother and that of the calf. The greatest difference between the bloods was in the red corpuscles and was largely accounted for by the organic acid-soluble fraction, which was over three times as high in the case of the calf at birth.

An unknown phosphorus fraction, insoluble in acid, was found in small and variable amounts in the red corpuscles of calves' blood, and even its occurrence was erratic. The lipid phosphorus fraction in the blood of the calf at birth may be equal to or greater than that of the mother, while the inorganic phosphorus fraction was appreciably higher in the case of the calf's blood. The potassium content of the calf's blood was approximately twice as high in the plasma and four times as high in red corpuscles as that of the mother. There were no characteristic differences in the calcium, magnesium, sodium, and chlorine contents of the blood of the calf and the mother.

VII. *The unknown phosphorus fraction of calf blood*, A. I. Malan and H. H. Green (pp. 391-396).—A study of the unknown phosphorus fraction of calves' blood showed it to be a nucleoprotein and that it was due to the presence of precursors of fully mature erythrocytes. This phosphorus fraction was also found at times in small amounts in human and horse blood and in large amounts in the nucleated erythrocytes of birds.

VIII. *Comparison of phosphorus partition in the blood of calf foetus, sheep foetus, and lambs, with corresponding maternal blood*, A. I. Malan (pp. 397-400).—A similar relationship was found for the phosphorus portion between the blood of lambs and their mothers as was found between the blood of calves and their mothers. In lambs' blood a considerable part of the acid-insoluble phosphorus fraction may be found in the red corpuscles, and may even be present in fetal blood. While the organic acid-soluble fraction is confined to the corpuscles, in one case a small amount was present in the plasma of a 6-month calf fetus.

IX. *The phosphorus partition of blood in anaemia of cattle and sheep*, A. I. MALAN (pp. 401-405).—The phosphorus portion of the blood in cases of anemia in cattle and sheep, due to various causes, showed an unknown phosphorus fraction confined to the corpuscles and evidently nucleoprotein. It was determined by difference between the total phosphorus and the sum of total acid-soluble and lipoid phosphorus, and at times made up a considerable part of the total phosphorus. It was associated with the appearance of nucleated red cells and disappeared when they did.

The composition and nutritive value of sugar beet pulp, H. E. WOODMAN and W. E. CALTON (*Jour. Agr. Sci. [England]*, 18 (1928), No. 3, pp. 544-568).—In a study at the institute of animal nutrition, Cambridge University, England, the composition of dried sugar beet pulp, wet sugar beet pulp, and molasses-sugar beet pulp was determined.

In trials with sheep, sugar beet pulp was shown to be highly digestible by ruminants. The digestibility of its nitrogen-free extract and total organic matter compared quite favorably with maize meal. The drying process did not depress digestibility, nor was digestibility disturbed by feeding the pulp dry or soaked. The crude fiber of the pulp was highly digestible, indicating that it is almost wholly in the form of a simple cellulose. The digestion coefficient of the protein was relatively low.

In this study 1 lb. of dried sugar beet pulp was found to be a carbohydrate concentrate capable of replacing 0.8 lb. of maize or 0.9 lb. of barley in the productive part of the rations of ruminants. It was also a relatively cheap source of digestible carbohydrate per unit of starch equivalent as compared with maize or barley.

Appended are tables giving the detailed results of the digestion trials.

Vasectomy as a method of sterilising ram lambs, J. QUINLAN (*Jour. Agr. Sci. [England]*, 18 (1928), No. 3, pp. 446-459, pls. 7, figs. 2).—In a study at the Government farm at Bestersput, South Africa, lambs from 2 to 4 months of age were selected and divided into two groups, one of which showed a predominance of wool type and the other a predominance of mutton type. In the mutton-type group, 37 lambs were vasectomized, 25 were used as control rams, 25 as control wethers, and 40 as control ewes, while in the wool-type group 44 were vasectomized, 26 were used as control wethers, and 30 as control ewes. All lambs but the ewes were run together, and the lambs were kept under veld conditions. The sheep were weighed monthly and sheared at the end of their first, second, and third years, when observations were made on the weight, length of staple, and character of the wool.

While the vasectomized sheep were sterile, it was found that even when the operation was performed at an early age the secondary sex characters of rams developed. The vasectomized sheep attained a greater weight than wethers or ewes, but had no more endurance or vitality and were equally susceptible to disease and temperature changes. The meat of the vasectomized sheep had the characteristic ram flavor, but this could be overcome by castration 6 months prior to slaughtering. The wool production of these sheep was equal to that of rams, and the wool was about the same quality. Vasectomized sheep developed larger skeletons than ewes or wethers, but their restless and pugnacious temperament prevented them from putting on as much flesh or attaining as high finish under veld conditions.

Spermatogenesis took place at 12 months and up to 2.5 years after vasectomy. Little or no hypertrophy was evident in sections of interstitial tissue made from 12 to 30 months after vasectomy.

[Experiments with swine at the Arkansas Station], E. MARTIN (*Arkansas Sta. Bul.* 246 (1929), pp. 39-42, fig. 1).—The studies with swine have been continued (*E. S. R.*, 60, p. 857).

Quality of meats with the by-products of rice.—In this test 6 lots of 11 pigs each, averaging approximately 53 lbs. per head, were fed in dry lot for an initial period of 8 weeks followed by a finishing period of 14 weeks, during 12 weeks of which the pigs were on rye pasture. The rations fed were as follows: Lot 1, rice polish, tankage, and minerals, self-fed during the initial period and changed to corn, tankage, and minerals during the finishing period; lot 2, the same as lot 1 except that alfalfa hay was added; lot 3, a mixture of rice polish 83.5 lbs., tankage 9 lbs., alfalfa meal 7.5 lbs., and minerals during the initial period, and corn, tankage, and minerals during the final period; lot 4, rice polish 79 lbs., tankage 6 lbs., alfalfa meal 15 lbs., and minerals, and later changed to brewers' rice, tankage, and minerals; lot 5, brewers' rice 83.5 lbs., tankage 9 lbs., alfalfa meal 5 lbs., and minerals, with the same feeds self-fed free choice during the second period; and lot 6, white corn chop 83.5 lbs., tankage 9 lbs., alfalfa meal 7.5 lbs., and later changed to corn, tankage, and minerals.

All of the pigs gained well at the start of the test, but by the end of the third week all lots receiving rice polish began to lose weight and continued to do so until the ration was changed. The results of carcass gradings of these pigs indicate that alfalfa hay or meal does not improve the feeding qualities of rice polish, that rice polish produces soft pork, and that brewers' rice produces pork with a firm, white fat.

Soybeans for hogs.—Continuing this study, 4 lots of 12 pigs and 4 lots of 6 pigs each, averaging approximately 127 lbs. per head, were fed Laredo, Virginia, and Mammoth Yellow soybeans and tankage, respectively. The lots containing 12 pigs had access to standing yellow corn and a mineral mixture, while the lots of 6 pigs received their soybeans in self-feeders and were grazed on Sudan grass pasture.

The average daily gains in the first 4 lots were 1.44, 1.67, 1.67, and 1.88 lbs. per head and in the last 4 lots 1.92, 1.97, 1.9, and 1.98 lbs. per head, respectively. In this study pigs averaging 125 lbs. initial weight and making average daily gains of 1.5 lbs. or more for approximately 8 weeks produced firm carcasses in practically 70 per cent of the cases, but when the average daily gain was 1.4 lbs. or less firm carcasses were produced in only about 50 per cent of the cases. The Laredo soybeans were again inferior to the other varieties.

Effect of feeding of dam on quality of pork produced.—A group of 9 gilts were developed on a ration of 60 lbs. of rice polish, 30 lbs. of rice bran, and 10 lbs. of tankage, with pasture and minerals. The sows were divided into 3 lots at farrowing time, and the ration of lot 1 changed to corn, shorts, tankage, and minerals. The second group had this ration changed when the pigs were weaned, and the third group 3 weeks after weaning. Of the 15 hogs marketed from lot 1, 4 carcasses graded hard, 7 medium hard, and 4 medium soft. Of the 17 from lot 2, 4 graded hard, 4 medium hard, 6 medium soft, and 3 soft, and of the 20 pigs from lot 3, 7 graded hard, 8 medium hard, 4 medium soft, and 1 soft. The average refractive index was 1.4596, 1.4598, and 1.4597 in the respective lots. These results indicate that rice polish and rice bran may be fed for 3 weeks after weaning without influencing the quality of pork, and this method of feeding offers a satisfactory way of utilizing these feeds.

Legume hays for brood sows during gestation and lactation.—To determine the value of legume hay, 4 lots of 3 gilts each, averaging approximately 257 lbs. per head, were used. A grain mixture of white corn chop and tankage, 95:5, plus a mineral mixture, was fed in lots 1 and 2, lot 1 receiving soybean ha:

and lot 2 alfalfa hay. Lot 3 received a grain ration of white corn chop and tankage, 90:10, plus the mineral mixture, while lot 4 was fed corn chop, alfalfa meal, and tankage, 85:10:5, plus the minerals.

Lot 4 farrowed the largest litters and lot 3 the smallest, but there was little difference in the size of litters in any of the lots. However, at weaning time all the pigs in lot 3 were dead, while the sows in the other lots weaned a large majority of their pigs. One day after farrowing the average weights of the pigs were 3, 2.7, 3.3, and 2.7 lbs. per head, and at weaning time the average weights were 15, 19.6, 0, and 14 lbs. per head, respectively. At farrowing time the average weight of all sows was approximately 355 lbs., but at weaning time the average weights per sow were 216.7, 213, 0, and 172.7 lbs. in the respective lots. The pigs in lot 3 seemed normal when farrowed, but showed signs of weakness on the second or third day and usually died within 48 hours following the symptoms of weakness. One sow in lot 1 died, and one in lot 4 became so emaciated that she had to be removed from the experiment.

These results show that, while both soybean and alfalfa hay supplied some of the deficiencies of the basal ration, it was impossible for the animals to consume enough to supply their demands during the suckling period.

Handbook on the bacon hog and hog grading, A. A. MACMILLAN (*Canada Dept. Agr. Pamphlet 40, n. ser., rev. (1929), pp. 24, figs. 16*).—This is a revision of the pamphlet previously noted (*E. S. R.*, 51, p. 175).

Stallion enrollment.—XVIII, Report of stallion enrollment board for the year 1929, with lists of stallions and jacks enrolled (*Indiana Sta. Circ. 168 (1929), pp. 40, figs. 2*).—This is the usual report of the stallion enrollment in Indiana for the year 1929 (*E. S. R.*, 61, p. 261).

[Poultry experiments at the Arkansas Station], R. M. SMITH (*Arkansas Sta. Bul. 246 (1929), pp. 43, 44*).—Studies with poultry are reported in continuation of those previously noted (*E. S. R.*, 60, p. 859).

Rice products for laying hens.—A lot of 20 Barred Rock pullets was fed for 243 days on a basal mash ration of equal parts of wheat bran, wheat shorts, yellow corn meal, ground oats, meat scrap, and 4 per cent of bone meal. With this a scratch ration of 2 parts of cracked yellow corn and 1 part of wheat was fed. A similar lot received a mash of 1 part each of rice polish, rice bran, and ground oats, $\frac{4}{5}$ part of meat scrap, and $\frac{1}{4}$ part of bone meal. In the scratch ration of this lot brewers' rice replaced the corn of the former lot. A third pen was fed in the same manner as lot 2, except that cod-liver oil replaced 2 per cent of the mash. Lot 4 received a mash made up of 1 part each of rice bran and rice polish, $\frac{4}{5}$ part of meat scrap, $\frac{1}{4}$ part of bone meal, and 2 per cent of cod-liver oil, and received the same scratch as lots 2 and 3.

The average egg production per bird was 109.6, 67.7, 115.5, and 108.8 eggs, while the percentage hatchability of the eggs was 62.8, 65.6, 45.9, and 52 in the respective lots. Based on the feed cost per dozen eggs, the rice products could be profitably used to make up almost the entire ration for laying hens if cod-liver oil was included.

Rice products in the growing ration.—To study the value of rice products for growing chicks, 3 trials were conducted using as a standard ration a mash of yellow corn meal, ground oats, wheat bran, wheat shorts, bone meal, cod-liver oil, and salt 23:23:23:23:5:2:1, and a scratch of finely ground yellow corn. The experimental ration consisted of rice polish, rice bran, bone meal, cod-liver oil, and salt 46:46:5:2:1, and a scratch of brewers' rice. Buttermilk was fed to all lots. At the beginning of the respective tests the chicks on the basal ration averaged 52.6, 48, and 46.3 gm., and those on the test ration 54.5, 50.5, and 48.2 gm. At the end of 8 weeks in the first 2 tests

and of the fourth week in the third, the basal groups averaged 520, 519, and 178 gm. and the test groups 568, 505.5, and 156 gm., respectively.

The influence of mineral, cod-liver oil, alfalfa leaf meal, and sprouted oats upon the production, hatchability, and fertility of the egg.—A basal mash, 1 part each of wheat bran, wheat middlings, sprouted oats, yellow corn meal, and 0.5 part of meat scrap, together with buttermilk, oyster shell, and grit, with a scratch ration of 2 parts of cracked yellow corn and 1 part of whole wheat, was fed to 5 lots of birds from November 29 to June 23. In addition the following supplements were fed: Lot 2, 4 per cent of bone meal and 1 per cent of salt; lot 3, 2 per cent of cod-liver oil; lot 4, 10 per cent of alfalfa leaf meal; and lot 5 sprouted oats.

The percentage production was 48.9, 53, 54.1, 43.6, and 50.1, the percentage hatchability 66.3, 72.5, 69.6, 70.1, and 59.8, and the percentage fertility 93.3, 93.3, 78, 92.3, and 92.3 in the respective lots. No decided advantage resulted from the addition of any of the supplements, and the mortality rates were practically the same in all lots. The birds in lot 5 gained slightly in weight during the test, but the other lots showed slight losses.

Digestibility trials with poultry, II, III, E. T. HALNAN (Jour. Agr. Sci. [England], 18 (1928), No. 3, pp. 421-431).—The digestibility studies at the University of Cambridge, England, have been continued (E. S. R., 60, p. 639).

II. *The digestibility of "weak" and "strong" wheats, and their value for poultry feeding* (pp. 421-425).—Digestion trials with so-called "strong" and "weak" wheats, using White Leghorn cockerels as experimental animals, indicated that the two wheats were equal as sources of food nutrients for poultry.

III. *The digestibility of "whole" and "flaked" maize* (pp. 426-431).—A comparison of the digestibility of the nutrients of "whole" and "flaked" maize, using cockerels as experimental animals, showed the average digestibility coefficients for whole maize to be as follows: Organic matter 84.6, protein 79.5, fat 78, and nitrogen-free extract 87.5 per cent. The corresponding figures for flaked maize were 93.8, 90.2, 81.5, and 95.1 per cent, respectively. These figures indicate that the steam cooking in the commercial processes of preparing flaked maize considerably increased the digestibility of the nutrients.

A trial to compare the ability of poultry and pigs to digest low-fiber feeds indicated that these animals were approximately equal in this respect.

Rearing chicks in confinement, H. H. ALP (Illinois Sta. Circ. 352 (1930), pp. 4, figs. 3).—A plan for confinement brooding, the construction of pens, the care and feeding of chicks during confinement, and summer roosting shelters are described in this publication.

Artificial incubation at high altitudes, F. J. KOHN (Wyoming Sta. Bul. 169 (1930), pp. 20, fig. 1).—Concluding this study (E. S. R., 60, p. 768), it was found that hatchability at high altitudes compared favorably with that at low altitudes, provided the relative humidity in the incubators averaged 50 per cent for 18 days of incubation and 60 per cent or more at hatching time. Eggs from trap nest selected breeding stock hatched 66 per cent in February and 78 per cent in March. A variation of from 0 to 100 per cent was found in the hatchability of eggs from birds in the same pen with approximately identical production.

All of the incubators tested were adaptable to the altitude and climate when the relative humidity in the egg chamber was high enough to prevent excessive evaporation of the eggs. When evaporation varied from 12 to 15 per cent for eggs not over 4 days old and 12 to 13 per cent for eggs 10 to 12 days old at the time incubation started, the best hatching results were obtained. Water trays and sand trays raised the relative humidity of the egg chamber to between 35 and 45 per cent, and additional moisture was supplied by means of wet sponges.

Cooling eggs was especially valuable with high incubation temperatures, retarding development and slowing down evaporation. The temperature requirement of hatching eggs was the same at high altitudes as at low altitudes at a relative humidity of 50 per cent. Relative humidity and egg temperature were found to be directly related.

Alfalfa proved to be the best winter green feed substitute in these studies. Sunflower silage was also a good substitute, but it required from 2 to 3 months to get the birds to eat it readily. Although cod-liver oil did not increase the hatchability in the corn-ration lots over that of the lots given green feed substitutes, it did maintain the birds at the peak of hatchability during the spring and summer months.

Preparing poultry produce for market, F. C. ELFORD (*Canada Dept. Agr. Bul.* 20 [n. ser.], rev. (1929), pp. 26, pl. 1, figs. 14).—This is a revision of Dominion Experimental Farms Bulletin 88 (E. S. R., 37, p. 682).

Poultry and poultry keepers, R. J. CRESPO (*Gallinas y Gallineros. Madrid: Espasa-Calpe, 1929, pp. 358, pls. 11, figs. 75*).—This is a practical treatise dealing with poultry, their relation to agriculture, their history, the different breeds of poultry, their internal and external morphology, their physiology, and nutrition and feeding practices.

DAIRY FARMING—DAIRYING

Dairy farming, W. J. FRASER (*New York: John Wiley & Sons; London: Chapman & Hall, 1930, pp. XIV+333, figs. 141*).—This is a treatise, prepared as a text for students and a handbook for dairy farmers, indicating the essential factors for getting the most milk and profit per acre.

[**Experiments with dairy cattle at the Arkansas Station**] (*Arkansas Sta. Bul.* 246 (1929), pp. 37-39).—The two experiments previously reported (E. S. R., 60, p. 862) have been continued.

Legume hays for dairy heifers, H. E. Dvorachek.—The 3 lots of heifers were fed for 26 14-day periods on the following rations: Lot 1, alfalfa hay, white corn chop, ground brewers' rice, and salt; lot 2, prairie hay and the same grain ration with the addition of linseed oil meal and steamed bone meal; and lot 3, the same as lot 2 with the addition of cod-liver oil. The hay was fed according to appetite and the grain in sufficient quantities to produce at least 1 lb. of gain per day.

The heifers fed alfalfa hay made smaller daily gains than those fed prairie hay. When fed on the basis of live weight it was necessary to feed 1.4 lbs. of grain with prairie hay to obtain slightly larger gains than by feeding 1 lb. of grain with alfalfa hay. No advantage was obtained by feeding cod-liver oil, since the gains in lots 2 and 3 were practically the same. The results indicate that alfalfa hay fed with a grain ration deficient in minerals, protein, and vitamins is not satisfactory for producing maximum gains, while prairie hay properly supplemented produces satisfactory gains.

Rice by-products for dairy cows, H. E. Dvorachek, M. S. Libbert, and C. C. Walts.—No significant differences were found in the specific gravity, refractive index, iodine absorption number, melting point, saponification number, percentage of soluble fatty acids, percentage of insoluble fatty acids, Reichert-Meissl number, and Polenske number of butters made from cream obtained from cows on a basal ration of alfalfa hay and corn silage to which had been added 5, 10, 15, 20, 30, or 40 per cent of rice polish. Two cows also in the test received no rice polish, and cottonseed meal was fed to all animals except one of the control cows.

Dairy situation, 1930, W. E. CONNELL ([Oklahoma] *Panhandle Sta., Panhandle Bul.* 14 (1930), pp. 7, 8).—This is a discussion of the 1930 dairy situation in the Panhandle country.

Ground versus unground soybean hay for dairy cows, L. W. INGHAM and DE V. MEADE (*Maryland Sta. Bul.* 316 (1929), pp. 219-230).—Using the double reversal method, 2 groups of 6 cows each were fed through 3 experimental periods of 30 days each, of which the first 5 days were regarded as preliminary, on the same basal grain and silage ration. Lot 1 was fed ground soybean hay for the first period, unground hay the second period, and ground hay the third period. Lot 2 was fed on unground hay the first period, then changed to ground hay, and finally returned to unground hay. The hay used was of good quality, leafy, and cut after the pods were well filled but before the seeds were mature. Records were kept of milk and butterfat production, and weights were taken of each animal at weekly intervals.

It was found that milk production was 1.31 per cent greater, fat production 4.84 per cent greater, and average butterfat tests 0.15 per cent higher on ground than on unground hay. Cows on unground hay refused 29.2 per cent of the hay offered, while those on ground hay refused only 11.07 per cent. Larger gains were made by cows on the ground hay than by those on the unground hay.

In this test it cost \$6.35 per ton to grind the hay. The net profit from grinding hay for 12 cows over a period of 25 days was only \$1.66, which is not considered sufficient to justify the practice except in cases where the cost of feed is of secondary importance.

The physiological effect of rations restricted principally or solely to the alfalfa plant.—I, The calcium, phosphorus, and nitrogen metabolism of dairy cattle, J. R. HAAG, J. S. JONES, I. R. JONES, and P. M. BRANDT (*Jour. Dairy Sci.*, 12 (1929), No. 6, pp. 445-455).—This is a more detailed account of work by the Oregon Experiment Station previously noted (*E. S. R.*, 61, p. 65), together with a general discussion of some of the factors which may be involved in rations restricted principally or solely to alfalfa.

Results of a long time mineral feeding experiment with dairy cattle, C. F. HUFFMAN and O. E. REED (*Michigan Sta. Circ.* 129 (1930), pp. 11, figs. 4).—The data reported in this publication have been noted previously (*E. S. R.*, 61, p. 464). Based on the results obtained in these studies the following conclusions were drawn: (1) Mineral supplements carrying phosphorus and calcium are not needed in the ration of growing cattle and milking cows fed a good quality of roughage and protein concentrate. (2) A mixture of steamed bone meal and salt, equal parts, will supply the phosphorus deficiency of a ration of legumes and cereal grains with no protein concentrate. (3) In goitrous regions a mixture of 0.05 lb. of pulverized sodium iodide or potassium iodide and 100 lbs. of salt should be added to the ration.

The joint influence of the period of lactation and the age of the cow on the yield and quality of the milk, T. J. DRAKELEY and M. K. WHITE (*Jour. Agr. Sci. [England]*, 18 (1928), No. 3, pp. 496-506, figs. 3).—Continuing this study (*E. S. R.*, 58, p. 571), the averages from the analyses of the milk of cows of the same age and breed at successive stages of lactation were calculated, and curves were drawn to pass as nearly as possible through the values thus obtained. From these curves tables were prepared to show independently the influence of both the stage of lactation and age of cow on the yield and quality of milk for the following breeds: Dairy Shorthorn, Jersey, Guernsey, British Friesian, Ayrshire, Lincoln Red Shorthorn, Red Poll, and Kerry.

The influence of the stage of lactation appeared to be about the same for all ages up to about 200 days from calving. For each breed the curves for

yield, percentage of fat, and percentage of solids-not-fat at successive ages were respectively parallel.

The influence of age of cow on the milk was the same at all stages of the lactation period, and the curves showing the effect of age on the cows of the same breed at different lactation periods were parallel.

Effect of heat (oestrus) on butterfat percentage and milk yield, L. COPELAND (*Jour. Dairy Sci.*, 12 (1929), No. 6, pp. 464-468, fig. 1).—Based on 2,025 Register of Merit records of the American Jersey Cattle Club, on which the testers had indicated heat periods during the supervision of tests, the author has determined the effect of heat on production.

A total of 211 comparisons were made of milk yields of the 1-day test period while the cow was in heat and the average milk yields of the 2 days preceding the test and the 2 days following. In 75 cases the heat period resulted in an increased milk yield, while in 131 cases the yield was lessened. The average variation in milk yield was 1.67 lbs., and the total of all tests showed an average decrease of 0.63 lb. in milk yield during the heat period.

Butterfat percentage showed a slight increase in 126 cases and a decrease in 81 cases. The average variation in butterfat percentage was 0.43 per cent and the average increase in all cases 0.13 per cent.

These results indicate that the effect of heat on milk production and butterfat percentage is very limited. No compensating increase was noted in milk production just prior to the heat period.

The mechanism of secretion of calcium and phosphorus in milk, N. C. WRIGHT (*Jour. Agr. Sci. [England]*, 18 (1928), No. 3, pp. 478-485).—In a study at the New York Cornell Experiment Station, the formation of colloidal CaHPO_4 by the interaction of CaCl_2 and NaHPO_4 in the presence of neutral caseinates was demonstrated. This colloidal CaHPO_4 was shown to be nondiffusible across a membrane of cellophane.

On this basis it appears that the concentration of calcium and phosphorus in milk depends on two general mechanisms, "first, the action of the casein, which is synthesized in the milk cells of the mammary gland from the freely diffusible amino acids of the blood . . . and is capable of causing a selective absorption of calcium by the formation of the slightly dissociated calcium caseinate, and, second, the process of supersaturation of this caseinate solution with CaHPO_4 , leading to the formation of a colloidal and nondiffusible solution of this salt which is consequently trapped in the milk cells."

Variations in the milk from different quarters of the same udder: Their significance in studies of coagulability, A. G. BENTON (*Jour. Dairy Sci.*, 12 (1929), No. 6, pp. 481-483).—This is a report of a study by the Bureau of Dairy Industry, U. S. D. A., in which there were variations in the volume, fat, serum solids, pH, alcohol test, coagulation test at 120° C., and bacterial count of the milk from different quarters of a cow. Detailed analyses were made of samples from 6 morning milkings over a period of 2 weeks.

The calculation of absolute viscosity from data secured by means of the torsion pendulum viscosimeter, R. WHITAKER and B. L. HERRINGTON (*Jour. Dairy Sci.*, 12 (1929), No. 6, pp. 456-463, figs. 2).—In this study by the New York Cornell Experiment Station a formula was developed that makes it possible to convert the degrees retardation, a measure of viscosity determined by means of the torsion pendulum viscosimeter, into centipoise, the unit of absolute viscosity.

Seasonal variations in the freezing point of milk, J. H. BUCHANAN and O. E. LOWMAN (*Jour. Dairy Sci.*, 12 (1929), No. 6, pp. 484-490, fig. 1).—This study showed that there was a distinct seasonal variation in the freezing point depression of milk. The greatest depression occurred in the spring

months and the least during the winter months. One explanation offered for the wide variations encountered is the change in meteorological conditions. However, the change in the chemical content of the animal's food during the season is the controlling factor in seasonal variations. The variations are the result of changes in the osmotic equilibrium maintained in the body of the animal.

Contribution to the knowledge of the taste of milk, C. L. ROADHOUSE and G. A. KOESTLER (*Jour. Dairy Sci.*, 12 (1929), No. 6, pp. 421-437).—In this contribution from the California Experiment Station, the results are reported of a study conducted at the Dairy Experiment Station, Liebefeld, Switzerland, dealing with the taste of milk at the time it is drawn from the cow. The influence of certain feeds or of stable odors on the milk were not considered.

Of 82 cows from which samples were taken, there were 8 cows that produced milk with an especially fine taste, 35 with a good taste, 11 with a slightly salty taste, 2 distinctly salty, 4 slightly rancid, 5 distinctly rancid, and 4 with a bad taste. An analysis of the milk of 3 cows with excellent primary tastes showed that the samples agreed quite closely in lactose and chloride content, but there was no especially close agreement in the coarsely dispersed components such as fat, protein, and some ash constituents. This chloride-lactose relation was found to be one of the most important bases of milk taste, a high ratio being less favorable than a relatively low ratio. The primary taste of skim milk was practically equal to that of the whole milk from which it was separated.

By dialysis it was possible to separate milk into two parts, dialyzate and residue, with extreme differences in taste. Practically all the milk components producing primary taste were present in the dialyzate, while the components in the residue were almost free from taste. Dialysis also demonstrated that fat and protein substances, as well as certain difficultly dialyzable salt components, take only a very small part in the primary taste of milk. Dialysis of milk with pronounced feed taste showed that most of the feed taste was found in the residue, which indicated that it was either not dialyzable or is combined with the milk fat or other nondialyzable components.

Cream and milk refrigeration experiments, F. E. PRICE (*Agr. Engin.*, 11 (1930), No. 1, pp. 33-37, figs. 4).—Data are reported from experiments conducted at the Oregon Experiment Station.

The results indicated that milk placed in a dry box was precooled to 65 to 67° F. over a surface cooler, using tap water. With baffled circulation the milk cooled about 1.5° per hour, reaching 50° in 12 hours. When using a fan for forced circulation the milk cooled to 52° in 6 hours and to 42° in 12 hours.

Milk at a temperature of 95° cooled to 60° in 1 hour, 54° in 2 hours, 52° in 3 hours, and 40° in 12 hours, and when precooled to 67° it cooled to 55° in 1 hour, 50° in 3 hours, and 37° in 12 hours in refrigerated, nonagitated water. When the cooling water was agitated, milk precooled to 68° cooled to an average temperature of 46° in 30 minutes. In 1 hour the temperature dropped to below 45°.

Milk that was cooled over a surface cooler to 60° and held in 60° water increased in bacterial count from 1,930 to 5,570 per cubic centimeter in 12 hours and to 88,500 in 24 hours.

[Experiments with butter making at the Arkansas Station], C. C. WALTZ (*Arkansas Sta. Bul.* 246 (1929), pp. 45-47).—These studies have been continued (E. S. R., 60, p. 865).

Neutralizing agents for sour cream.—Analyses of various neutralizing materials show that they are composed largely of calcium and magnesium oxides or sodium carbonate and bicarbonate. Practically all the limes were entirely or partially hydrated and all contained considerable impurities, of which the

chief objectionable impurity was clay. The sodas were highly pure substances. Most of the limes were very finely ground, a desirable feature since such material makes a smooth suspension in water and reacts more quickly and completely with excess acid. Some of the soda neutralizers were more coarsely ground than others, but this did not materially affect their solubility.

All of the soda materials were completely soluble in a 0.9 per cent lactic acid solution, but the limes varied considerably in this respect. The limes containing a high proportion of magnesium were the most economical neutralizers from the standpoint of alkalinity, followed by straight calcium limes, while sodas were the least economical.

The effect of various starter cultures on butter flavor.—A study of the scores of butter made in a total of 225 churnings of sweet and neutralized sour cream, using 9 different commercial starter cultures, showed rather conclusively that no one starter was decidedly better than any other for improving the flavor of butter, although all of the starters improved the flavor of butter as compared with butter made without a starter. When 0.2 per cent of sodium citrate was added to two of the starters there was an apparent improvement in the flavor and aroma of the starter.

The butter industry of Oregon: A study of factors relating to the quality of butter, E. S. LARRABEE and G. WILSTER (*Oregon Sta. Bul.* 258 (1929), pp. 30, figs. 6).—Continuing the survey of the butter industry in Oregon (E. S. R., 55, p. 382), a study was conducted in cooperation with the U. S. D. A. Bureau of Dairy Industry, to determine the factors having a bearing on the quality of butter produced, whether higher grades could be made under existing conditions, and what changes would be necessary to make higher and more uniform grades of butter. Observations and tests were made in the field, laboratory tests were conducted, and marketing studies were made in the course of the investigation.

As a result of this survey, it was found that the quality of Oregon butter could be improved by using better methods of manufacture and by improving the quality of the cream delivered to the creameries.

Potassium nitrate in Canadian cheese, F. C. HARRISON (*Canad. Jour. Research*, 1 (1929), No. 3, pp. 256-260).—A study of discoloration of colored Canadian cheese at McGill University suggested that saltpeter had been added to the cheese for the purpose of restraining or controlling certain injurious fermentations. When saltpeter was added to milk from which experimental cheeses were made, an unevenly distributed discoloration resulted and became very marked as the cheese aged. Nitrate-reducing organisms were isolated from all discolored cheese which when inoculated into sterile milk with annatto and saltpeter produced the typical discoloration. It was also found that fresh nitrated cheese gave positive tests for nitrates. During the aging period the nitrates were reduced to nitrites, but tests for nitrites after aging showed that all the nitrite had evidently been converted into ammonia or free nitrogen. Some of the commercial saltpeters may contain nitrate-reducing organisms, and a water organism, *Pseudomonas fluorescens*, capable of causing discoloration, was isolated from some cheeses.

Based on these results, it is recommended that the use of saltpeter in cheese be discontinued.

Controls for alkali cleaning solutions, W. G. GOSS (*Agr. Engin.*, 11 (1930), No. 1, pp. 17, 18).—Data are reported which were presented at the National Dairy Industries Exposition at Toronto in October, 1929. They indicate that for satisfactory results milk bottles should be subjected to a cleaning solution of from 3 to 4 per cent caustic strength for 5 minutes or more, at a temperature

of 150° F. Caustic strength and time factors are interchangeable to some extent between temperatures of 120 to 160°.

Proceedings of the annual meeting of the American Dairy Science Association (*Jour. Dairy Sci.*, 12 (1929), No. 6, pp. 507-512).—A brief résumé of the meeting held at Washington, D. C., June 26-28, 1929, together with the titles of the papers presented in the various sections of the association (El. S. R., 61 p. 105).

VETERINARY MEDICINE

[Report of work in animal pathology at the Arkansas Station], W. L. BLEECKER (*Arkansas Sta. Bul.* 246 (1929), pp. 47-49, fig. 1).—In a study of the diagnostic agglutination titer of pullorum disease of fowls the station purchased 30 birds that agglutinated *Salmonella pullorum* in a dilution of only 1 to 10 or in a few cases not higher than 1 to 20. These birds were autopsied aseptically and transfers were made from the degenerated ovules, liver, and heart into brilliant green agar, with the result that from 3 of the birds autopsied proved cultures of *S. pullorum* were isolated. The work indicates that if an agglutination titer of 1 to 25 is used as the basis upon which a flock is culled, a relatively large number of diseased birds remain as a menace to the health of the present flock and serve as a source of infection for the chicks of the following year. It is recommended that when the blood serum of a fowl agglutinates a suspension of *S. pullorum* organisms in a dilution of 1 to 10 it be considered a carrier of pullorum infection and be removed from the flock.

In work with the cloudy reaction in the agglutination test it was found the preceding year that none of the antigens used entirely eliminated cloudy reactions, but that the one to which 0.04 per cent of sodium hydroxide was added was the most efficient in preventing precipitation, with that containing 1.8 per cent of sodium chloride next in value. In the work during the year cloudy reactions occurred frequently in all the antigens used, but the two that appeared to be the most efficient in preventing the cloudy reactions were those containing 0.04 per cent of sodium hydroxide. The antigen containing 5 per cent of sodium chloride appeared to be of little value, while that containing 1.8 per cent was second only to that containing 0.04 per cent of sodium hydroxide. The one containing 1.8 per cent of sodium chloride plus 0.04 per cent of sodium hydroxide did not appear as valuable as the antigen containing but one of these chemicals.

In studying the variability in the morphology of *Bacillus anthracis* when grown on a variety of media, it was shown that this organism would grow on an agar agar containing but the very slightest trace of peptone as the only source of nutriment. Its cultural and morphological characters, however, were entirely atypical when thus grown. When stained the organisms appeared like cocci, except that they were larger. Upon guinea pig inoculation they were found to be entirely avirulent. It was found that when this atypical form was returned to nutrient agar it assumed the normal shape in the second generation, that by the fourth generation normal rough colonies with typical curled margins appeared, and that in the fifth generation this type of colony was the only one to be found. Upon inoculation into guinea pigs no virulence was demonstrated through the thirteenth generation, the last five of which were grown on blood agar.

[Report on] veterinary science, J. McFADYEN (In *Agricultural Research in 1927*. London: Roy. Agr. Soc. England, 1928, pp. 161-190).—Reviews are given of research work and the status of knowledge of the following subjects:

Foot-and-mouth disease (pp. 161-166), vaccination against tuberculosis (pp. 166-171), bovine tuberculosis in cattle in Canada (pp. 171-173), lamb dysentery (pp. 173-177), botulism (pp. 177-179), grass diseases of horses (pp. 179-181). Borna disease (pp. 181, 182), epizootic abortion (pp. 182-185), rabies (pp. 185-188), and fowl pox (pp. 188-190).

[Report on] veterinary science, J. McFADYEAN (In *Agricultural Research in 1928*. London: Roy. Agr. Soc. England, 1929, pp. 163-193).—This is a report on the occurrence of and control work with the diseases of livestock, including tuberculosis, (1) vaccination of cattle against it and (2) the causes of the disease in the different species of domesticated animals; contagious or epizootic abortion, (1) epizootic abortion and Malta fever, (2) the diagnosis of the disease, and (3) the disease in Finland; garget or mastitis; foot-and-mouth disease; Johne's disease; liver rot in sheep; lamb dysentery; and contagious pustular dermatitis in sheep.

Annual report of the Civil Veterinary Department, Punjab, for the year 1928-29, J. SINGH, W. R. WILSON, U. W. F. WALKER, W. TAYLOR, L. W. SMITH, and J. S. GAREWAL (*Punjab Civ. Vet. Dept. Ann. Rpt. 1928-29*, pp. [2]+V+6+41+XXII, pls. 13).—This is the usual annual report (E. R. S., 61, p. 567).

The bacteriophage and its clinical applications, F. D'HERELLE, trans. by G. H. SMITH (*Springfield, Ill.: Charles C. Thomas, 1930*, pp. VII+254, figs. 10).—The several chapters of this work deal with bacteriophagy (pp. 1-27), bacterial mutations (pp. 28-64), the nature of bacteriophage (pp. 65-98), infectious diseases (pp. 99-128), recovery and immunity (pp. 129-164), and the use of bacteriophage (pp. 165-228).

Hypersensitiveness to helminth proteins.—II, Cutaneous and precipitin tests with *Ascaris* extracts in infected and immunized animals, F. A. COVENTRY (*Jour. Prev. Med.*, 3 (1929), No. 1, pp. 43-62, figs. 4).—This paper is an outgrowth of the previous work (E. S. R., 61, p. 174).

Cutaneous reactions of the delayed type were found to follow the intracutaneous injection of *Ascaris* extracts in rabbits and guinea pigs infected with *Ascaris*, and occur in rabbits (probably also in guinea pigs) immunized with *Ascaris* extract. They vary greatly in intensity, but may persist for months after the total disappearance of worms from infected animals. They appear to be of the "hypersensitivity to infection" type. Preliminary experiments failed to show passive transfer of the skin hypersensitivity. The reactions are specific in that they are not evidenced in infected or immunized trichinous rabbits. It was found that precipitins can be demonstrated in the serum of infected and immunized rabbits and guinea pigs, which vary greatly in titer during the course of experimentations but may persist for at least eight months in rabbits. The intensity of skin reactions fails to parallel the precipitin content of the serum.

Carriers among certain rodents surviving experimental paratyphoid-enteritidis infections, S. E. BRANHAM and L. ROBEY (*Jour. Prev. Med.*, 3 (1929), No. 5, pp. 377-383).—Young guinea pigs were found to be relatively resistant to infection with the food poisoning strains of *Salmonella enteritidis* and *S. aertrycke* fed to them, and none of the survivors were found to be carriers. Young wild gray rats were highly susceptible to infection with the strain of *S. aertrycke* fed to them, but recovery was apparently complete. No carriers were found among them. White mice proved susceptible to all of the 17 strains of *S. aertrycke* and *S. enteritidis* fed to them. A mortality of about 90 per cent occurred in a series of 250 mice. Of 26 survivors, 9 were found harboring the homologous type of organism 6 weeks after infection and 3 weeks after they had ceased to excrete them in the feces. In 4 of the 5 harboring *S. aertrycke*, this organism was found in the gall bladder. This

suggests the possibility of a true carrier state which may be an important factor in cases of food poisoning involving these organisms.

Report of case of tularaemia contracted from a coyote (*Canis lestes*) in New Mexico. G. M. KUNKEL (*Pub. Health Rpts. [U. S.]*, 45 (1930), No. 9, pp. 439, 440).—This is a report of a case of tularaemia contracted from a coyote in Lincoln County, N. Mex., it being the second case (*E. S. R.*, 56, p. 56) of the disease contracted from this animal to be reported in literature.

Public health aspects of undulant fever. W. W. LEE (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 6, pp. 679-694).—This is a discussion of the subject by the epidemiologist of the Indiana State Board of Health given at the annual meeting of the American Veterinary Medical Association at Detroit, Mich., in August, 1929.

Effect of diet on the resistance of the albino rat to *Bacterium abortus*. R. HOAGLAND and J. M. BUCK (*Jour. Agr. Research [U. S.]*, 40 (1930), No. 3, pp. 201-208).—The details are here given of feeding experiments with albino rats conducted with a view to determining the effects of certain dietary deficiencies on the resistance of the rats to *B. abortus*. Rations deficient in vitamin A, the antineuritic vitamin B, vitamin E, and in calcium and phosphorus, respectively, were without significant effect on the resistance of the rat to this organism.

A comparison of the rapid and slow agglutination methods for the diagnosis of Bang abortion disease in cattle. S. R. DAMON (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 6, pp. 761-764).—In a large series of tests in which the slow and rapid methods of testing blood sera for agglutinins for *Brucella abortus* in parallel were employed, the rapid method was found to be more sensitive than the slow. It is concluded that the rapid method will detect more quickly certain animals that are positive or should be regarded with suspicion than will the slow agglutination test. The delicacy of the rapid method, together with the care necessary in preparation and standardization of the antigen used, makes it a test applicable only in the hands of experienced laboratory workers.

Recent progress in our knowledge of milk fever. P. A. FISH (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 6, pp. 695-700).—In summarizing the present status of knowledge the author points out that the evidence demonstrated and confirmed during the past six years has shown milk fever to be a hyperglycemia, a hypocalcemia, and a hypophosphatemia.

On the cause and therapy of grass staggers [trans. title], B. SJOLLEMA (*Tijdschr. Diergeneesk.*, 57 (1930), Nos. 2, pp. 67-79; 3, pp. 149-171, *Ger.*, *Eng. abs.*, pp. 163-171).—The author here deals with the etiology, pathogenesis, and therapy of the grass staggers that occurs in the first days that the cows are at pasture.

Ragwort poisoning in cattle and cirrhosis of the liver in horses. J. F. CRAIG, W. KEARNEY, and J. F. TIMONEY (*Vet. Rec.*, 10 (1930), No. 8, pp. 159-174, *figs. 3*).—This extended discussion includes reports of cases of poisoning due to *Senecio jacobaea* L.

The possible toxicity of grain-sorghum smuts. V. G. HELLER, C. CASKEY, and R. PENQUITE (*Jour. Agr. Research [U. S.]*, 40 (1930), No. 4, pp. 347-351, *figs. 3*).—The facts that grain sorghums have proved to be especially adapted to some of the more arid sections of this country where they are grown and fed in large quantities to livestock and that many members of this group are subject to kernel smut infections led to investigations of their toxicity by the Oklahoma Experiment Station. The work conducted and here reported included feeding experiments with rats and other small animals and horses and cows.

It was found that certain types of grain sorghums often have as high as 70 per cent of the heads affected with kernel smuts which replace the grain kernels. Biological tests using rats, guinea pigs, and rabbits failed to reveal any deleterious results in growth, reproduction, and rearing of young when as high as 10 per cent of smut spores replaced an equal amount of carbohydrates in an otherwise adequate diet. Chickens were fed without ill effect upon rations prepared from smutty seed. Horses, cows, and young cattle were fed smutty sorghum grain and fodder without displaying any symptoms of toxicity. During the observation of all of the more than 65 animals no sickness or deaths occurred. Young animals grew as well as the controls. Old animals maintained their weight. Reproduction took place at normal periods with four types of animals, and neither the egg production of hens nor the milk production of cows was altered by feeding sorghum smut in a form as concentrated as it occurs in the field. This was true with larger farm animals even when their ration was somewhat inadequate.

On the nature, cause, and possible prevention of the "walking disease" among horses and cattle, C. H. HAYS and L. VAN ES (*Lincoln: Nebr. Dept. Agr., Bur. Anim. Indus., 1929, pp. 12, pl. 1, figs. 7*).—This is a practical summary based upon investigations by the Nebraska Experiment Station, a report of which has been noted (E. S. R., 61, p. 768).

Infectious pustular dermatitis of sheep and goats, J. A. HOWARTH (*Jour. Amer. Vet. Med. Assoc., 75 (1929), No. 6, pp. 741-760, figs. 5*).—In work in California the author has demonstrated the presence of a filtrable virus in both the vesicopapular lesions and the scabs of infectious pustular dermatitis of sheep and goats. These appear to be the only animals susceptible to the virus. The author was unable to obtain an infective filtrate each time with the same type of filter, thus showing that the filtrability of the etiological agent is carried out with the greatest difficulty. Animals that recovered from an experimental inoculation and those that passed through an attack of the disease were found to possess a high degree of immunity. Rabbit inoculation failed to demonstrate the presence of *Bacillus necrophorus*, thus differentiating the condition from so-called lip and leg ulceration. The infection may assume enzootic proportions and the outlook may appear very grave at first, but if the animals are allowed to go untreated recovery soon takes place.

Miscellaneous experiments with anthelmintics, chiefly alkyl-chlorides, in the treatment of nematode infestations of sheep, R. DAUBNEY (*Vet. Jour., 86 (1930), No. 655, pp. 5-50*).—This is a report of work with the common sheep hookworm *Bunostomum trigonocephalum*, by far the most serious pest of sheep in Kenya Colony. The details of the work are presented in tabular form.

It was found that drugs administered to sheep by drenching pass in bulk to the rumen and do not reach the abomasum and small intestine for some considerable time after ingestion. Capsules pass to the rumen and open in that division of the stomach. Carbon tetrachloride alone administered by stomach tube proved to be from 91 per cent to 100 per cent efficacious against hookworms in a single dose at a dose rate of 0.1 cc. per pound body weight, but at this dose the drug killed four animals out of a total of nine tested. Smaller doses given in soft gelatine capsules produced no fatalities. A single dose of 3 cc. given in this manner was the smallest completely efficacious dose. The addition of a comparatively large dose of magnesium sulfate to the treatment completely protected animals against the toxic action of large doses of the drug, without in any way impairing its anthelmintic efficacy. Carbon tetrachloride displayed no anthelmintic activity against nodular worms, *Oesophagostomum columbianum* or against *Ostertagia* or *Trichostrongylus*.

Tetrachlorethylene showed a variable efficacy against hookworms, ranging from 9.3 to 100 per cent. It is not likely to prove as useful as carbon tetrachloride in the treatment of infestations in sheep. Tetrachlorethane, pentachlorethane, and trichlorethylene proved valueless owing to their extreme toxicity. Hexachlorethane in one sample proved to have a high efficacy against hookworms, but a second sample was considerably less active. Sodium trichloracetate, ethyl trichloracetate, and paradichlorobenzene were of no value against hookworms, nodular worms, or small trichostrongyles. Copper sulfate and tobacco infusion and turpentine and linseed oil failed to remove any hookworms in spite of the fact that they are frequently recommended for this purpose. The administration of oil of chenopodium to sheep intravenously is so dangerous that the method is impracticable as an anthelmintic measure.

Variations in the plasma cholesterol and cholesterol ester content in hog cholera, R. E. SHORE (*Jour. Bact. Med.*, 51 (1930), No. 2, pp. 179-187, figs. 2).—The author found that the plasma cholesterol and cholesterol ester content of swine experimentally infected with hog cholera exhibit a regular succession of changes. "During the period of incubation of the disease, for three or more days following inoculation with hog cholera virus, hypocholesterolemia prevails. This is followed by a period of hypercholesterolemia which is coincident with the onset of the clinical manifestations of the disease. The hypercholesterolemia, after persisting for from 4 to 7 days, gives way to a second period of hypocholesterolemia more marked and more prolonged than that observed immediately after inoculation. In the experiments of the present work this second period lasted 8 and 11 days in the two animals surviving long enough for the study of it and was followed by a second period of hypercholesterolemia. In the one animal surviving this period for 8 days, a third period of irregular and fluctuating hypocholesterolemia set in.

"A comparison with the results in other acute infections indicates that hog cholera is unique in showing alternating periods of hypocholesterolemia and hypercholesterolemia. A normal hog inoculated with *Bacillus suisepiticus* rapidly developed the typical marked hypocholesterolemia, whereas an animal infected with hog cholera and then inoculated with *B. suisepiticus* failed to show the decrease in plasma cholesterol content."

Studies in infectious enteritis of swine.—IV, Intestinal coccidiosis, H. E. BUESTER and C. MURRAY (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 6, pp. 705-740, figs. 10).—In this fourth contribution (E. S. R., 61, p. 73) the authors deal with coccidiosis, which they consider to be an important but hitherto overlooked disease of swine in this country. The oöcysts of swine origin have been cultured in potassium dichromate with the addition of charcoal, a temperature of from 21 to 32° C. being found suitable for growth. Daily aeration was found necessary for development. Only one species was met with, the size of the forms found in swine on farms in Iowa corresponding to *Eimeria debilecki* reported from Europe.

The constancy of the agglutination test in the detection of bacillary white diarrhea, P. R. EDWARDS and F. E. HULL (*Jour. Amer. Vet. Med. Assoc.*, 75 (1929), No. 6, pp. 765-768).—In work conducted at the Kentucky Experiment Station variations were observed in the repeated agglutination tests upon infected birds, but they were slight. In 984 tests made of the blood of infected fowls only 6 were negative, 5 of the 6 occurring in hens which at the beginning of the experiment gave weak, partial reactions to the test. It was only in the cases of 4 birds that the titer became so low that no agglutination was present at 1:40.

During the course of the experiment 5 birds were lost. Post-mortem examinations were made of the remaining 88 hens. *Salmonella pulloform* was re-

covered from 80 hens, *S. sanguinaria* from 1, streptococci from 1, and in 6 cases the examination was negative. In the case of the hen from which *S. sanguinaria* was isolated, the organism was apparently confined to the ovary. The organisms were not isolated from the heart, spleen, or liver. The ova were discolored and misshapen, resembling ova infected with *S. pullorum*. This hen was in apparently good health, being killed for post-mortem examination at the end of the experiment. No other cases of fowl typhoid occurred in the flock.

Transmission of pullorum disease (bacillary white diarrhea) in incubators, H. BUNYEA and W. J. HALL (*Jour. Agr. Research* [U. S.], 40 (1930), No. 3, pp. 209-223, figs. 6).—In the experiments here reported pullorum-disease infection was transmitted from diseased chicks to healthy chicks by exposure in an incubator for 18 to 24 hours from the time of hatching, without actual contact between the chicks. A large percentage of the chicks so exposed succumbed to the disease even under the most favorable subsequent brooding conditions. There appeared to be a seasonable variation in the death rate due to this disease, the losses being greatest during the height of the laying season. It was found that the hatchability of eggs in incubators was higher than under hens, but livability of hen-hatched chicks surpassed that of incubator chicks. The transmission of pullorum disease among incubator-hatched chicks was about the same as among hen-hatched chicks.

AGRICULTURAL ENGINEERING

[**Agricultural engineering investigations at the Arkansas Station** (*Arkansas Sta. Bul.* 246 (1929), pp. 9-11, fig. 1).—In the work on preservation of posts, H. T. Barr reported that studies made in the laboratory to determine the effect of toxic chemicals on wood-destroying fungi in post woods showed that little or no fungus growth occurred and that wood was undamaged when treated with copper aceto arsenite, copper arsenite, and copper borate, thus indicating the value of copper compounds for preservative treatment. Creosote and melted sulfur gave approximately the same results. After 3 years in the ground 30 per cent of the untreated post specimens showed complete failure and 85 per cent showed some damage from termites or fungus growth. In the same period less than 2 per cent of the specimens with various treatments were destroyed, and little damage was noted on 262 test pieces.

In service tests galvanized steel posts were sound and in good condition after six years, painted steel posts were sound but badly rusted with some pitting, and pressure-treated pine posts showed no decay. Unseasoned butt-treated oak posts, with 62 per cent failure after 4 years, showed no further failures after 5 years. Cured native oak posts with 24-hour butt treatment in hot and cold bath failed 3.1 per cent after 5 years, 16.8 after 6 years, 28.06 after 7 years, and 33.3 per cent after 8 years.

In experiments on pumping plants for rice irrigation, B. S. Clayton and D. G. Carter found that a total of 34 in. of depth over the fields represents a normal supply of water for rice, and that the pumping requirements approximate 22 in. to supplement the rainfall. Evaporation losses during the hottest part of the summer were found to exceed 0.25 in. per day. Studies on the cost of pumping indicated that probably 150 acres is the area at which oil engine and electric power costs are about equal. On small plants the cost of attendance is relatively high for oil engines. Total irrigation costs per acre on three motor installations on areas of from 85 to 90 acres were approximately \$11 per acre per 100 ft. of lift. Oil engine plants cost from \$9 to \$11 per acre for areas of from 130 to 200 acres.

Carter also reported data on farm building plans and farm home costs, much of which has been previously noted (E. S. R., 62, p. 177).

Effect of lumnite cement and plaster of Paris caps on strength of concrete test cylinders, D. J. TRIPP (*Colorado Sta. Bul. 349 (1929), pp. 12, figs. 7*).—Experiments are reported which showed that the variation in the strength of individual cylinders is probably greater than any variation likely to occur due to method of capping. It appears that the different methods of capping do not give the same relative differences in strength when used on cylinders of various strengths. In other words, the method of capping which gives the highest strength for 1,800-lb. concrete may not give the highest for 5,000-lb. concrete. Apparently it is the strength of the cylinders and not the age which determines the effect which different methods of capping have on the strengths obtained.

Rough ends appear to have little effect on the strength when the lumnite cap is used, but give a considerably lower strength with plaster of Paris caps. The strength shown may be only 70 per cent of the true strength in the case of high-strength cylinders. The maximum variation between the strength given by the lumnite cap and the strength shown by the standard cap is only about 5 per cent. It appears from the results obtained that strengths shown by these two caps are about the same for 3,000-lb. concrete, which is probably very close to the average of all of the cylinders tested. Since the standard cap is the accepted one, it appears that there can be no serious objections to the use of the lumnite cap. An important advantage of this cap is that it has shown itself to be far easier to apply to uncapped field cylinders than any other cap tried in this laboratory.

Effect of section and various compositions on physical properties of cast iron, R. S. MACPHERBAN (*Amer. Soc. Testing Materials Proc., 29 (1929), pt. 2, pp. 76-82, figs. 7*).—This paper reports a study of the effect of section on the tensile strength and hardness of hard low-silicon gray iron, soft high-silicon gray iron, and high-test cast iron. While the two gray irons were appreciably harder at the sides than at the center, the high-test iron had practically uniform Brinell hardness throughout. The tensile strength of the high-test iron was found to decrease as the thickness of the bar increased.

Static strength of plain and alloy cast iron, F. B. COYLE (*Amer. Soc. Testing Materials Proc., 29 (1929), pt. 2, pp. 87-93, figs. 6*).—Graphic and other data are reported from tests showing the effect of composition, particularly the elements nickel and chromium, on the tensile strength and structure of cast iron. The opinion is expressed that the only tests for strength of cast iron which give absolute results are those for tension and compression.

Elastic properties of cast iron, J. T. MACKENZIE (*Amer. Soc. Testing Materials Proc., 29 (1929), pt. 2, pp. 94-99, figs. 3*).—Formulas are evolved for the modulus of elasticity and for the deflection or elongation of cast iron.

Cast iron has been found to show pronounced plastic deformation on the first few applications of load. On subsequent applications of the same stress it appears to be fully elastic, although higher stress will cause additional flow, which will disappear after a few loadings at this stress. Graphic data from tests are presented which show striking correspondence between the amount of plastic deformation and the graphite content. This suggests that a large part of the plastic deformation is due to some crushing of graphite flakes, or to squeezing of iron grains into the flakes or the voids surrounding them. It is shown also that the ultimate modulus of elasticity is an index of the resistance to plastic deformation.

The fatigue properties of cast iron, J. B. KOMMEES (*Amer. Soc. Testing Materials Proc., 29 (1929), pt. 2, pp. 100-108, figs. 2*).—The results of studies

conducted at the University of Illinois and University of Wisconsin on the fatigue properties of 14 lots of cast iron are reported.

The Illinois tests included tension, compression, Charpy impact, Brinell hardness, and rotating-beam fatigue tests. The fatigue strength of cast iron was found to be markedly increased by often repeated stress below the endurance limit. Grooves in cast-iron test specimens reduced the endurance limit only a small amount. The fatigue, tension, and Brinell hardness tests were made at high temperatures, and there was no great reduction in these values up to a temperature of about 800° F.

Tests on range of stress showed that the endurance limit for stresses from zero to a maximum tension were 1.48 times the endurance limit for completely reversed flexural stress. Formulas are given by means of which the maximum unit stress for various ratios of minimum to maximum stress may be computed approximately.

The Wisconsin tests included tension, compression, transverse, Russell impact, Rockwell and Brinell hardness, and the rotating-beam fatigue tests. The materials ranged from low strength to high strength cast irons. The ratio of endurance limit to tensile strength showed an average value of 0.49, and the ratio of endurance limit to modulus of rupture showed an average value of 0.26.

Impact testing of cast iron, H. BORNSTEIN (*Amer. Soc. Testing Materials Proc.*, 29 (1929), pt. 2, pp. 109-114).—This is an analysis of the impact testing of cast iron, with particular reference to its use in farm machinery. It is pointed out that no standard method of test has been developed. While there appears to be some disagreement between investigators, it is stated to be the consensus of opinion that irons high in static strength are also high in impact value. In many cases, it is pointed out, the impact test is of greater value in predicting results in service than are static tests, especially where the casting is to be subjected to shock.

Wear testing of cast iron, A. L. BOEGEHOLD (*Amer. Soc. Testing Materials Proc.*, 29 (1929), pt. 2, pp. 115-125, figs. 4).—A review is given of investigational work which has been done from time to time on the wear testing of cast iron. It is pointed out that there is no agreement between various investigators as to the method of testing for wear of cast iron or in their opinions regarding the influence of various elements in cast iron upon resistance to wear. A method of test is described relating to the wear testing of cast iron for automotive engine cylinder blocks. The results of a second test, using individual cylinders of four different kinds of cast iron, showed that the kind of cylinder iron used had no influence upon the result because of good lubrication between the piston and the cylinder.

The conclusions reached are that a universal wear test is undesirable, but that laboratory wear tests in which service conditions are imitated produce valuable data. It has been found that wear testing with lubricants present is difficult.

Machineability of cast iron, E. J. LOWRY (*Amer. Soc. Testing Materials Proc.*, 29 (1929), pt. 2, pp. 126, 127).—It is pointed out that, although machineability of cast iron is a function of abrasion, hardness, and ductility, hardness alone can not be considered as a true indicator of machineability since it does not measure the abrasive quality of the metal. Any influence which tends to eliminate abrasiveness increases machineability, such as annealing, higher silicon content, higher carbon content, or the addition of nickel, titanium, or any other softening alloy.

Corrosion of cast iron, H. O. FORREST (*Amer. Soc. Testing Materials Proc.*, 29 (1929), pt. 2, pp. 128-137, figs. 2).—In a contribution from the Massachusetts

Institute of Technology, data are reported which indicate that the factors affecting the corrosion of cast iron include not only the characteristics of the metal itself, but also to a greater extent the composition of the corroding medium and the type of protective coating employed. It appears that the coatings may either be applied or precipitated upon the metal. Preliminary tests indicated only small differences in the rates of corrosion of cast-iron pipe manufactured by different processes.

Corrosion tests in soils pointed to the fact that in general the nature of the soil rather than the types of metal is the factor which governs the corrosion rate. Cast iron was found to be slightly superior to steel or wrought iron in corrosion resistance in the atmosphere.

Heat treatment of cast iron, F. B. COYLE (*Amer. Soc. Testing Materials Proc.*, 29 (1929), pt. 2, pp. 138-141).—Data are given on the important features involved in the heat treatment of cast iron.

Recent developments in corrosion-resistant and heat-resistant steels, J. A. MATHEWS (*Indus. and Engin. Chem.*, 21 (1929), No. 12, pp. 1158-1164, figs. 4).—Information on various commercial products is presented.

Public Roads, [February, 1930] (*U. S. Dept. Agr., Public Roads*, 10 (1930), No. 12, pp. 213-228+[2], figs. 17).—This number of this periodical contains the status of Federal-aid road construction as of January 31, 1930, together with the following articles: The Arlington Curing Experiments, by L. W. Teller and H. L. Bosley (pp. 213-225); and Need for Simplification of Sizes in Sand and Gravel Industry, by F. H. Jackson (pp. 226-228).

Cold carburetion, C. H. KINDL (*S. A. E. [Soc. Automotive Engin.] Jour.*, 26 (1930), No. 2, pp. 159-162, figs. 7).—Experiments on engine operation without the addition of heat to the fuel-air mixture are reported. The work was initiated with a single-cylinder engine, using kerosene as fuel, to ascertain the results that could be obtained without vaporizing the fuel in the manifold. Very little vaporization was found to occur in the manifold. Sufficiently good distribution was obtained with one fuel orifice for each pair of cylinders of a multiple cylinder engine, although it is thought that a jet for each cylinder and individual valve ports are likely to give more perfect distribution. Better results were obtained from the system applied to an overhead-valve engine than to an engine of the L-head type.

Detonation characteristics of some of the fuels suggested as standards of antiknock quality, J. M. CAMPBELL, W. G. LOVELL, and T. A. BOYD (*S. A. E. [Soc. Automotive Engin.] Jour.*, 26 (1930), No. 2, pp. 163-168, figs. 5).—It is the purpose of this paper to report quantitative data on the detonation characteristics of certain engine fuels. The data are presented in terms of compression ratio for incipient knock over the entire range of composition from 0 to 100 per cent concentration, as determined in admixture with normal heptane.

Normal heptane seems to be the only one of the several fuels included in the survey that has sufficient tendency to knock to make it suitable for the lower limit of a scale of antiknock quality consisting of two pure fuels mixed in various proportions, one of low and one of high antiknock quality. Of the fuels from which a selection might be made for the upper limit of such a scale, cyclohexane, isooctane, benzene, toluene, and alcohol appear to have certain advantages and disadvantages, some of which are discussed.

Gaseous explosions.—VIII, Effect of tetraethyl lead, hot surfaces, and spark ignition on flame and pressure propagation, M. SOUDERS, JR., and G. G. BROWN (*Indus. and Engin. Chem.*, 21 (1929), No. 12, pp. 1261-1268, figs. 15).—In experiments conducted at the University of Michigan the effect of tetraethyl lead, both in the vapor phase and thermally decomposed, on flame speeds

and rate of rise of pressure following ignition was determined for explosive mixtures of benzene, pentane, isohexane, and heptane in air.

Tetraethyl lead vapor was ineffective in retarding combustion until decomposed by the burning mixture, whereas decomposed tetraethyl lead introduced before firing the charge retarded both flame speed and rate of rise of pressure. The introduction of a hot surface into the bomb to secure auto-ignition of the charge ahead of the advancing flame produced an unusually high rate of rise of pressure. Decomposed tetraethyl lead prevented or delayed the auto-ignition and retarded the resulting combustion.

High-frequency pressure waves ordinarily present in the explosions were eliminated by decreasing the number of sparks in the igniting discharge. The effect of these waves on the combustion and on the initiation of a violent shock wave was determined.

Factors affecting the drillability of fertilizers, A. L. MEHRING (*Indus. and Engin. Chem.*, 21 (1929), No. 12, pp. 1219-1223, fig. 1).—Tests by the division of agricultural engineering of the Bureau of Public Roads and the Bureau of Chemistry and Soils, U. S. D. A., of the materials and mixtures representative of the fertilizers now in use in several standard fertilizer distributors are reported.

The results showed that the drillability of the fertilizers varied greatly with changes in relative humidity and only slightly with differences in temperature. All of them could be drilled satisfactorily at any humidity below 50 per cent, but none when exposed for a few days to a humidity above its hygroscopic point. Materials containing a considerable proportion of particles fine enough to pass a 200-mesh screen were unduly dusty when dry and undrillable when slightly damp, while those consisting of particles between 5 and 80 mesh were easily drilled when slightly damp and could be distributed in every case in atmospheres below their hygroscopic points.

The drillability of a fertilizer was found to vary inversely with its kinetic angle of repose. Mixed fertilizers composed of particles of different size, shape, and specific gravity were found to segregate more or less during distribution, causing in some cases marked changes in the ratio of fertilizer delivered from time to time. The nearest approach to perfect distribution was obtained with a fertilizer composed of from 20- to 30-mesh rounded particles and having an angle of repose of 40°.

Design and operation of commercial sweet potato storage houses, M. A. R. KELLEY (*Virginia Truck Sta. Bul.* 67 (1929), pp. 719-765, figs. 20).—The investigation upon which this bulletin is based was conducted cooperatively by the station and the division of agricultural engineering of the U. S. D. A. Bureau of Public Roads. It was undertaken primarily to demonstrate the possibility of maintaining fairly uniform conditions in sweetpotato storage structures and to obtain data upon which to base recommendations for design and operation.

The results indicate that uniform temperatures, with reasonable control of humidity, can be maintained in sweetpotato storage houses of the type tested. The moisture loss from sweetpotatoes cured on a commercial scale at a temperature between 80 and 85° F., was found to be less than from those cured at a lower temperature. A temperature of from 38 to 40°, required for the storage of locally grown white potatoes, may be maintained readily if the storage house is well insulated and properly operated. It was found difficult to hold imported northern white seed potatoes in common storage beyond the first of February at a temperature sufficiently low to insure against early sprouting.

Improvements in design and construction are recommended.

Temperature instruments in the milk industry, R. E. OLSON (*Agr. Engin.*, 11 (1930), No. 1, pp. 12-16, figs. 10).—This paper was presented at the National Dairy Industries Exposition at Toronto in October, 1929. In dealing with temperature instruments used in the milk industry, it is pointed out that the three features of importance are construction, installation, and operation. In construction the five important major points are sealed adjustment, sturdiness and rigidity, moisture-proofness, durability and finish, and sanitation, with particular reference to those parts in contact with milk.

Modern water purification methods for the dairy, M. F. COBIN and E. S. HOPKINS (*Agr. Engin.*, 11 (1930), No. 1, pp. 19-22, figs. 2).—Data are reported which were presented at the National Dairy Industries Exposition at Toronto in October, 1929.

It is pointed out that no matter how much scouring compound is used perfect results in the washing of milk cans, bottles, churns, pasteurizers, and the like can not be obtained with water containing hardness. It is considered essential that a perfectly softened, zero hardness water be used to get the desired degree of cleanliness. So-called milkstone is a consequence of hardness minerals in the water, being caused by the precipitates which form when detergents are added to water containing hardness and involving also the protein constituents of milk. Attention is drawn to the advantages offered by the so-called zeolite process of softening water for use in dairies.

The effect of two types of cast-iron steam radiators on air temperatures in room heating, A. C. WILLARD and M. K. FAHNESTOCK (*Heating, Piping and Air Conditioning*, 2 (1930), No. 3, pp. 185-191, figs. 6).—The results of studies conducted at the University of Illinois are reported. These indicate that the steam condensation of a direct cast-iron radiator expressed in pounds of condensate is not an adequate measure of the performance of the radiator. Apparently the heating effect produced on the air in the room must be taken into consideration in making comparisons between different types of radiators.

Long, low cast-iron radiators placed under windows were found to heat a room more comfortably and more economically than higher column radiators placed at the side of the windows. Long, low, cast-iron radiators maintained materially better floor to ceiling temperature differentials than high column radiators. The larger portion of the temperature differential in a room heated with direct cast-iron radiators of the column and tubular types occurs between the floor and the breathing level. The temperature used as an indication of whether or not a room is properly heated should be taken at some level nearer the floor than the breathing level.

RURAL ECONOMICS AND SOCIOLOGY

[Papers presented at the twentieth annual meeting of the American Farm Economic Association] (*Jour. Farm Econ.*, 12 (1930), No. 1, pp. 1-173, figs. 4).—Included are the following papers and discussions thereon presented at the twentieth annual meeting of the American Farm Economic Association, held in Washington, D. C., December 27-30, 1929: Policy and Program of the Federal Farm Board, by A. Legge (pp. 1-12); Some Possibilities and Problems of the Federal Farm Board, by J. S. Davis (pp. 13-28); Farm Relief Measures in Selected European Countries, by C. L. Stewart (pp. 29-56); A Foreign Agricultural Information Service, by A. Hobson (pp. 57-68); The Agricultural Tariff of 1922 and a Look Ahead, by B. H. Hubbard (pp. 69-79); Analysis of Tariff Duties, by J. D. Black (pp. 80-106); A Program for the Improvement and Elaboration of Data Needed for Commodity Price Forecasting, by O. C. Stine (pp. 107-118); Evaluation of Methods Used in Commodity Price Forecasting, by E. J. Working (pp. 119-138); The Commercial Application of Fore-

casting Methods, by D. R. G. Cowan (pp. 139-163); and The Vermont Commission on Country Life, by H. C. Taylor (pp. 164-173).

Report of proceedings of conferences of the [Agricultural Economics] Society ([*Reading, Eng.*]: *Agr. Econ. Soc.*, 1929, pp. 129, pl. 1. figs. 4).—This report continues the series previously noted (*E. S. R.*, 62, p. 480) and includes the following papers, with discussions thereon, presented at conferences held in London, December 12, 1928, and in Cambridge, June 21-24, 1929: Some Impressions of Agriculture Economics in U. S. A., by A. W. Ashby (pp. 10-18); Recent Developments in Cooperative Marketing in Scottish Agriculture, by T. G. Henderson (pp. 19-32); Some Indications of the Nature and Extent of the Present Agricultural Depression, by R. J. Thompson (pp. 38-51); The Incidence of Notices to Quit and Rent Reductions as an Indication of Farming Conditions, by D. Skilbeck and M. Messer (pp. 52-65); Some Human and Social Factors in the Agricultural Depression, by A. W. Ashby (pp. 80-99); Farming Efficiency and the Agricultural Depression, by A. W. Ashby and J. L. Davies (pp. 100-108); Some Aspects of Foreign Competition in Relation to Agricultural Produce, by J. P. Maxton (pp. 109-116); and Some Economic Causes of the Agricultural Depression, by R. R. Enfield (pp. 117-129).

The reports of advisory agricultural economists regarding the position of farming in their respective areas are also included.

[Investigations in agricultural economics at the Arkansas Station, 1928-29] (*Arkansas Sta. Bul.* 246 (1929), pp. 67-75, figs. 3).—Results not previously noted are reported as follows:

[*Cost of producing strawberries*], C. O. Brannen and O. J. Hall (pp. 72, 73).—Revised data for the investigation previously noted (*E. S. R.*, 57, p. 683) show that the total costs per quart with cost rates as of 1918 were 11 cts. in the southwest district, 8.3 cts. in the northwest district, and 8.7 cts. in the White County district.

Organization, management, and cost of production on rice farms, O. J. Hall (p. 75).—Tentative results from the 107 farms included in the 1927 survey indicate the following averages per farm: Acreage 329; acreage in rice 165; acreage in oats, soybeans, cowpeas, and hay 34; investment in real estate \$24,562, in machinery \$2,569, in livestock and poultry \$645, and in feed, supplies, etc. \$176; and net receipts \$1,995. Of the cash receipts more than 96 per cent was from rice. About 50 per cent of the farmers had borrowed capital. The average indebtedness per farm in 1927 was \$6,403 and the average interest paid about 6.9 per cent.

The mechanization of agriculture, W. H. DEAN and J. B. BENNETT (*Washington: Chamber Com. U. S., Agr. Serr. Dept.*, [1929], pp. [2]+17).—This mimeographed report, which is a companion report to that previously noted (*E. S. R.*, 62, p. 178), describes the mechanical status of agriculture and some of the recent developments in agricultural mechanization, and discusses the changes which have accompanied the increasing use of power on farms.

The tax system of Iowa, J. E. BRINDLEY and G. S. M. ZORBAUGH (*Iowa Agr. Col. Ext. Bul.* 150 (1929), pp. 94, figs. 28).—This study was made by the Extension Service, Iowa State College, in cooperation with the U. S. D. A. Bureau of Agricultural Economics, in accordance with an appropriation to the former to be "used for research work in the incidence of State and county taxes."

An analysis was made of the relation of the sale prices and assessed values in 1927 of 2,150 rural properties in 12 counties, 1,305 properties in 90 towns, 1,298 properties in 6 of the larger cities of the State, and of the average ratios of assessed value to sales value in 2 counties, by years, for the periods 1907-1927 and 1916-1927, respectively. It was found that it is a common practice to assess some property two or three times as high as other property

similarly situated. The extreme spread in the rural districts was 10 to 1 and in the towns and cities nearly 20 to 1.

Analysis was made of the distribution of taxes from both an administrative and a functional point of view. The property taxes levied in 1927 were distributed administratively as follows: School district 44.7 per cent, county 23.2, city 14.4, State 9.3, township 5, and miscellaneous 3.4 per cent. Property taxes were found to constitute more than four-fifths of all the revenue from taxes. The total sum raised through property taxes increased about 463 per cent from 1893 to 1927. The average tax levy during the period increased from 32.3 to 101.258 mills. While highway revenues, excluding bond issues, increased from \$4,257,187.18 in 1904 to \$33,208,184.40 in 1927, the percentage received from the property tax decreased from 99.97 to 40.43, due to Federal aid after 1916 and the increase of receipts from the motor vehicle tax and the tax on gasoline beginning with 1925. School revenues increased from \$9,686,722.40 in 1903 to \$47,333,141.61 in 1923, but the percentage received from the local property tax decreased only from 100 to 98.64. The tax levies in 1927 for 1,093 common schools, 385 consolidated schools, and 917 accredited high schools were studied. Those for common schools varied from 0 to 40 mills, averaging 22.2 mills; those for consolidated schools from 11.3 to 136.4 mills, averaging 59.25 mills; and those for high schools from 5.93 to 214 mills, averaging 66.7 mills.

A study was made of the data on farm rents and taxes secured for the period previous to 1926 in farm management surveys made by the agricultural economics staff of Iowa State College, for 1926 in a survey made by the Iowa Farm Bureau Federation, and for 1927 through a questionnaire circulated by county agents in 74 counties and from cost accounts from 119 owner-operated farms. The percentage the taxes were of net rent before deducting taxes increased from an average of 14.2 for the period 1913-1915 to 28.3 for the period 1926-1927 on the cash rent farms, and from 7.7 for the period 1913-1915 to 27 for 1926 on the share rent farms. On the owner-operated farms, the percentage taxes were of net income increased from 4.5 for the period 1913-1916 to 22.5 in 1927. Information gathered for 1927 regarding 171 business and 360 resident properties in 9 representative cities showed that the percentage of rent absorbed by taxes was 31.5 for the business properties and 29.9 for the resident properties. The data for the farm, business, and resident properties are analyzed and discussed on the basis of districts of the State, groups according to the percentage taxes were of rent or income, method of renting farms, etc.

The percentages of net profits taken by taxes in the case of corporations organized for different purposes are also discussed, and a brief description and discussion is included of the tax situation in Switzerland, France, and Great Britain.

Semi-annual index of farm real estate values in Ohio, July 1 to December 31, 1929. H. R. MOORE (*Ohio State Univ., Dept. Rural Econ. Mimeogr. Bul. 23 (1930), pp. 15, fig. 1*).—This is a continuation of the study previously noted (*E. S. R., 62, p. 483*).

An economic survey of the "Dixie" section, Washington County, Utah. W. P. THOMAS (*Utah Sta. Bul. 214 (1930), pp. 56, figs. 14*).—This survey was made to determine the present farm organization of the area, marketing methods and costs, competition from California in truck crops, and the opportunities for changing farming practices in the area with a view of taking advantage of the favorable climatic conditions for the production of early fruits and vegetables. The report is based chiefly on 69 farm business records for the year 1928 secured from representative farmers of the district; similar data secured from the Moapa Valley, Nev., for 1928; 36 survey records taken in January, 1929, from wholesale truck distributors, jobbers, and retail dealers in Salt Lake City; information

from the U. S. Department of Agriculture and extension service workers of the Utah Agricultural College as to acreage, production, shipments, etc.; and information on freight rates, supplies of vegetables and fruits needed, and similar information secured from officials of the Union Pacific Railroad Company.

An analysis of the 69 farm business records shows the present situation of the area as to capital invested, utilization and value of land, yields and returns from different crops, number and returns from different kinds of livestock, farm expenses, farm income, and similar information. The general factors affecting the production and marketing of farm products of different kinds in the area are discussed. Special attention is given to the analysis of the data pertaining to the yields, costs of production, costs of marketing, and returns from and the marketing possibilities for bunched vegetables, green peas, fresh tomatoes, asparagus, and cantaloupes.

Adjusting agricultural production and distribution in the Beckley area to meet home market demands, W. W. ARMENTROUT (*West Virginia Sta. Bul. 226 (1930), pp. 20, figs. 5*).—This is the third report of the series previously noted (*E. S. R.*, 56, p. 786). Included are tables showing, by months, for commodities being produced to some extent in the farming sections of the area the receipts by freight and express in Beckley, the carrying charges, and the State or city from which shipped. Most of the tables cover the period April, 1925, to March, 1927, inclusive. Some recommendations are given regarding the further increase of local production of the different commodities.

Car-lot shipments of fruits and vegetables from stations in the United States for the calendar years 1926 and 1927, compiled by E. LAWRENCE and L. NOBGEN (*U. S. Dept. Agr., Statis. Bul. 27 (1929), pp. 156*).—Tables are given showing for different fruits and vegetables for 1926 and 1927 the car-lot shipments by States, counties, and shipping points, the total United States car-lot shipments by commodities and by States, and the approximate shipping seasons by States. The information given supplements that in the bulletin previously noted (*E. S. R.*, 57, p. 88).

Crops and Markets, [February, 1930] (*U. S. Dept. Agr., Crops and Markets, 7 (1930), No. 2, pp. 33-80, figs. 3*).—The usual tables, graphs, reports, summaries, and notes are included. Other tables show, by States, the estimated numbers and farm values of different kinds of livestock on January 1, 1928, 1929, and 1930; average monthly farm prices, 1910-1929, of different kinds of livestock and poultry and their products; and, by States, for the 35 late potato States the production, quantity sold or available for sale, and merchantable stock on the following January 1 for the potato crops of 1927, 1928, and 1929, the average acreage of potatoes harvested in 1928 and 1929, the prospective utilization of the 1929 crop, and the intended acreage in 1930.

Facts about cotton, 1930 outlook (*U. S. Dept. Agr., Bur. Agr. Econ., 1930, pp. [2]+23, figs. 15*).—This series of mimeographed charts and tables presents data for various periods regarding the production, price, acreage, and yield of cotton in the United States, gross farm income from cotton and cottonseed in the United States, relation of cotton consumption and industrial production in the United States, foreign production of cotton, world carry-over, and the relation of gross income from cotton and expenditures for fertilizer in cotton States of the United States. Other charts and tables show the relation between world supply and market value of cotton at New Orleans, the relation of price of cotton and industrial stocks and other commodities, changes in number of persons living on farms in the Southern States, 1924-1929, and changes in the acreage of cotton and other crops and in the number of livestock on farms in the Southern States during 1926 and 1927,

The tariff on oils and fats, C. W. HOLMAN ET AL. (*Baltimore, Md.: Lord Baltimore Press, 1929, pp. XII+107, figs. 16*).—This is a brief in support of increases in rates of import duties on and changes in classification of all the vegetable, animal, and marine fats, oils, greases, and the related oil-bearing raw materials. It was submitted to the Committee on Ways and Means of the U. S. House of Representatives February 28, 1929, by the author and his associates representing the allied agricultural organizations and independent crushers of oil materials.

Besides the main brief covering general tariff considerations, our tariff relation to the Philippine Islands and to our export trade, and statistics of production, prices, imports, and exports of vegetable, animal, marine oils, fats, greases, and related raw materials, briefs on marine animal oils, by W. R. Morse, and on the cod-liver oil tariff problem, by H. F. Taylor, are included.

Onions, T. O. MARVIN ET AL. (*Washington: U. S. Tariff Comm., 1929, pp. VIII+83, figs. 3*).—This is the report of the U. S. Tariff Commission to the President of the United States on the differences in costs of production and other advantages and disadvantages in competition of onions in the United States and the principal competing country.

It sets forth the information obtained by the Commission in regard to United States consumption, production, and importation of onions; methods of marketing, storing, packing, and grading of domestic and imported onions; domestic farm prices: wholesale prices in central markets of domestic and imported onions; domestic and foreign costs of production; and transportation costs. The costs of production calculated by four methods showed that the domestic costs exceed the foreign costs by 1.505, 1.623, and 1.428 cts. per pound, respectively.

An appendix includes the proclamation of the President of December 22, 1928, increasing the rate of duty on onions from 1 to 1.5 cts. per pound.

The world wheat situation, 1928-29: A review of the crop year, M. K. BENNETT ET AL. (*Wheat Studies, Food Research Inst. [Stanford Univ.], 6 (1929), No. 2, pp. [1]+41-110, figs. 24*).—This is the sixth of the series previously noted (*E. S. R.*, 61, p. 289), and reviews for the crop year 1928-29 the supply position, stocks and carry-overs, wheat price movements, and the international trade in wheat and flour.

Survey of the wheat situation, August to November, 1929, M. K. BENNETT ET AL. (*Wheat Studies, Food Research Inst. [Stanford Univ.], 6 (1930), No. 3, pp. [1]+111-150, figs. 10*).—A continuation of the series previously noted (*E. S. R.*, 62, p. 181). The production of wheat and other cereal crops in 1929, marketing and visible supplies in the leading countries, international trade, wheat price movements, and the outlook for trade, carry-overs, and prices are discussed.

The post-harvest depression of wheat prices, H. WORKING and A. M. HOBE (*Wheat Studies, Food Research Inst. [Stanford Univ.], 6 (1929), No. 1, pp. [1]+40, figs. 5*).—An analysis is made of the monthly cash wheat prices, July, 1899-1914, and July, 1921-1928, of No. 2 hard winter wheat at Kansas City, No. 2 red winter wheat at St. Louis, and No. 1 northern spring wheat at Minneapolis, of the May wheat futures prices at Chicago during the same periods, and of the spreads between the cash and futures prices. The apparent dealers' profits from storage and the potential gains from farm storage are discussed.

The study showed that the tendency to post-harvest depression of prices is highly variable from year to year and is restricted to cash prices, there being no evidence of a general tendency toward post-harvest depression of prices of Chicago wheat futures. The cash prices tendency is one of depression

of cash prices relative to prices of futures. At the 1913 price level, the average change in cash-futures spread per month and the estimated possible average gain from storage per month were, respectively, 0.71 and 1.1 cts. per bushel for No. 2 hard winter wheat at Kansas City, 1.21 and 1.21 cts. for No. 2 red winter wheat at St. Louis, and 0.46 and 0.88 ct. for No. 1 northern spring wheat at Minneapolis. The allegation that the post-harvest depression of wheat prices during the present century has generally been excessive, permitting exorbitant profits from wheat stored by dealers, was found to be without foundation. Although most farmers can store wheat more cheaply than dealers, the possible profits were found to be small and might readily be converted into losses by an unwise storage policy.

The unsound economics of the F. A. Q. Standard for selling Australian wheat, G. L. SUTTON (*Jour. Dept. Agr. West. Aust.*, 2. ser., 6 (1929), No. 4, pp. 480-495, figs. 5).—The ways in which the "Fair Average Quality" standard used in Australia in selling wheat does not "indicate the quality of the product in a reliable, understandable, and definite manner at the time the offer is made" by a buyer are discussed.

Foreign trade of the United States, annual, 1790-1929: Wheat and wheat products and rye and rye products, C. G. GILES (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 46* (1930), pp. [1]+85, pls. 2).—This set of mimeographed tables showing the annual exports, imports, reexports and net balance, quantity, and value of wheat, wheat products, rye, and rye products, 1790-1929, includes tables as follows: Wheat (grain); wheat flour; wheat including flour in terms of grain; bread and biscuit; macaroni, vermicelli, and similar products (1860-1929); other wheat products for table use (1922-1929): bran, shorts, middlings, etc.; other mill feeds (1913-1929); rye (grain); rye flour; and rye including flour in terms of grain.

Other tables show the imports into the United States from Canada for milling in bond from July, 1919, to September, 1929, inclusive, and the shipments to Alaska, Hawaii, and Porto Rico, 1903-1929, of wheat and wheat products, and 1903-1910 of rye and rye flour.

Agricultural survey of Europe: Hungary, L. G. MICHAEL (*U. S. Dept. Agr., Tech. Bul. 160* (1930), pp. 104, figs. 7).—This bulletin continues the series previously noted (*E. S. R.*, 62, p. 283). It describes the agricultural situation, utilization of land, population, land reform, production of the principal crops and kinds of livestock in Hungary and their place in the foreign trade of the country, and the probable future of the foreign trade in different products. Analyses are made for wheat, rye, and bread cereals (wheat and rye) of the relation of production and domestic disappearance to exports for different periods, and equations are derived as a basis for forecasting the probable exportable surpluses of these grains.

The possible future competition of Hungary with the United States in the several agricultural products is discussed, and the conclusion is reached that "unless marked improvement is made in production methods, the long-time competition of Hungary with the farmers of the United States will be marked by decreased exports of cereals and increased shipments of animals and animal products up the Danube River."

The agricultural output of Northern Ireland, 1925, D. A. E. HARKNESS (*Belfast: North. Ireland Min. Agr.*, 1928, pp. [6]+84, pls. 13).—Tables and charts are presented and discussed showing the changes from 1847 to 1927 in utilization of land, acreage and yields of different crops, and the numbers of different kinds of livestock. The production and disposal, 1925, of different crops, livestock and livestock products, and the estimated total value of agricultural produce are discussed. Other tables and discussions pertain to th

changes in the number and size of agricultural holdings, changes in the population in rural and urban districts, 1841-1926, the agricultural organization, the distribution of crops and stock on different classes of farms, the output of timber, 1925, and the flax scutching trade.

The agricultural output and the food supplies of Great Britain, H. L. FRENCH (*London: Min. Agr. and Fisheries, 1929, pp. VII+55*).—This publication summarizes the reports previously noted dealing with the agricultural output of England and Wales (E. S. R., 57, p. 485) and Scotland (E. S. R., 61, p. 289), and Northern Ireland, noted above. Comparisons are made of the gross output of livestock and livestock products, farm crops, and fruits, vegetables, flowers, etc., in 1908 (a pre-war year), 1925 (a postwar year), and subsequent years; of the quantities of imported raw materials contributing to the gross output in 1907 and 1924; and of the net value of the agricultural output for about 1908 and the average, 1924-25 to 1927-28.

The second part of the publication is devoted to a consideration of the total quantity and value of the different foodstuffs consumed in Great Britain during pre-war and postwar periods, of the changes in the per head consumption of the various commodities, and of the supplies of commodities provided by home production and by imports from other parts of the Empire and from foreign countries.

The dairy industry as a basis of colonisation in Palestine, I. ELAZARI-VOLCANI and A. SUSSMANN (*Tel-Aviv: Palestine Econ. Soc., 1928, pp. XII+205*).—The status of dairy stock and of forage crops, the marketing of milk, capacity of the internal markets of Palestine, and the international dairy market are described. The factors operating in milk production in Palestine and the factors to be considered in transferring to dairying are discussed. Some data collected from account books and by questionnaires and verbal inquiries regarding the costs of milk production are analyzed and presented.

Trends in American sociology, edited by G. A. LUNDBERG, R. BAIN, and N. ANDERSON (*New York and London: Harper & Bros., 1929, pp. XII+443, figs. 6*).—The purpose of this volume is to set forth what are, in the opinion of some of the younger workers in the field, the domains and methods of sociology. Included are chapters as follows: The History and Prospects of Sociology in the United States, by J. Bernard (pp. 1-71); Trends in American Sociological Theory, by R. Bain (pp. 72-114); Trends in Social Psychology, by J. F. Markey (pp. 115-171); The Developing Study of Culture, by D. P. Gary (pp. 172-220); The Trend of Rural Sociology, by C. C. Zimmerman (pp. 221-260); The Trend of Urban Sociology, by N. Anderson (pp. 261-296); Educational Sociology, by D. H. Kulp II (pp. 297-313); Sociology and Social Work, by H. A. Phelps (pp. 314-343); Trends in Applied Sociology, by R. Bain and J. Cohen (pp. 344-383); and The Logic of Sociology and Social Research, by G. A. Lundberg (pp. 389-425).

AGRICULTURAL AND HOME ECONOMICS EDUCATION

A proposed program of research [in vocational agricultural education], F. W. LATHROP (*Agr. Ed. [Des Moines], 2 (1930), No. 2, pp. 19, 32*).—This paper, read before the agricultural section of the American Vocational Association in December 1929, summarizes briefly the research that has been done in vocational agricultural education, makes some suggestions as to further studies, and points out the relationships of the Federal Board for Vocational Education and the States in research in this field.

A manual for sheep club members, W. G. KAMMLADE and E. I. PITCHARD (*Illinois Sta. Circ. 351 (1930), pp. 48, figs. 24*).—This is a manual giving funda-

mental information to assist members of boys' and girls' sheep clubs in developing a high class farm flock.

Rural social science, G. A. LUNDQUIST and C. B. MOORE (*Boston and London: Ginn & Co., 1929, pp. XI+483, figs. 69*).—This is a textbook designed for rural high schools. The 60 chapters are divided under the headings of the rural social background; moral and mental, social, religious, educational, political, and economic factors; and social service. Each chapter is followed by a list of questions and problems for discussion and a list of suggested readings.

Training supervisors of home economics education, W. B. MCNEAL ET AL. (*Fed. Bd. Vocat. Ed. Bul. 143 (1930), pp. IX+14*).—This report of the special committee on home economics education of the National Committee on Advanced Courses in Vocational Education contains the analysis of replies from 56 State supervisors of home economics and former State supervisors and the general recommendations of the committee for a program of training supervisors of home economics vocational education.

FOODS—HUMAN NUTRITION

The nutritive value of cereal breakfast foods, I, II (*Jour. Nutrition, 2 (1929), No. 1, pp. 83-110*).—The two papers noted below form a part of an extensive investigation of the nutritive value of various package cereal breakfast foods. For the purpose of the report these are designated as follows: Rolled Oats, a product made from the whole grain minus the hull by precooking and crushing between rollers; Precooked Oats, a similar product steamed for a much longer period; Toasted Corn Endosperm, a corn product made from the decorticated and degerminated corn treated with a small amount of cane sugar and salt, cooked under steam pressure, dried, rolled, and toasted on hot rollers; Wheat Endosperm, a product made from decorticated and degerminated wheat sterilized by heat, but not cooked; "Toasted Whole Wheat"; and "Whole Wheat." The last two are given in quotations because, although claimed to be prepared from the whole wheat grain, their low fat content indicated that the products did not contain the whole of the grain.

I. Composition and heat value, J. R. Murlin, W. R. Line, H. A. Piper, and H. B. Pierce (pp. 83-90).—Tables are given of the proximate analyses and heat values determined by the bomb calorimeter and compared with physiological values for the six cereal products listed above. The composition figures, which were all calculated to the dry basis for comparison, showed differences which were to be expected from the statements of the manufacturers, with the exception of the so-called whole wheat products, the fat percentages of which were so low as to indicate the removal of some of the germ. In the table of heat values, the physiological values were calculated from the composition and from the percentage utilization figures as determined in a part of the investigation to be reported later. The comparison of the values as thus obtained with the heat of combustion values indicated a loss in heat value from nonabsorption and noncombustion of protein of 0.498 calorie per gram or 10.4 per cent for Rolled Oats, 0.165 calorie per gram or 4.1 per cent for Toasted Corn Endosperm, 0.25 calorie per gram or 5.6 per cent for Wheat Endosperm, and 0.412 calorie per gram or 9.3 per cent for "Whole Wheat." The greater loss of the whole grains or nearly whole grains than of the endosperm products is attributed to the low digestibility of the bran.

In combustion values Rolled Oats was highest, followed in decreasing order by "Whole Wheat," Wheat Endosperm, and Toasted Corn Endosperm. Precooked Oats was not tested, and "Toasted Whole Wheat" gave the same value as "Whole Wheat."

On the basis of these studies, the Rolled Oats was considered to rank first in actual value to the body, the Wheat Endosperm next, and the Toasted Corn Endosperm and "Whole Wheat" tied for the third place.

II. *Digestibility in vitro, with a study of methods*, J. S. Carman, H. G. Smith, G. C. Havens, and J. R. Murlin (pp. 91-110).—Three different methods were used. The first consisted essentially in carrying the same materials through a digestion by salivary amylase, pepsin-HCl, trypsin, and diastase, successively. The second consisted also in successive digestions, but the individual samples were weighed and cooked separately and a particular study made of the effect of different digestion periods and different lengths of cooking. Neither of these methods proved entirely satisfactory. In the third the digestion by different enzymes was tested separately. The technic followed, one of the features of which was the use of sodium tungstate for the precipitation of undigested residues, is described in detail. The products tested included Wheat Endosperm, Precooked Oats, "Whole Wheat," and "Toasted Whole Wheat."

The results of the salivary digestion tests demonstrated the very rapid rate of salivary action on the starch of cooked cereals. Long boiling improved the digestion only slightly. The cooking of any of the cereals 5 minutes only gave a very good start to salivary digestion. In the peptic digestion experiments, cooking for 30 minutes increased the digestibility over cooking for 15 minutes in all of the cereals except "Toasted Whole Wheat," and cooking for 1 hour increased the digestibility of all of the cereals. The proteins of the cereal grains found in the bran and germ were less digestible than in the endosperm. The rate of trypsin digestion was increased in all cases except the Precooked Oats by increasing the time of cooking from 5 to 15 minutes in single boilers and decreased by cooking for more than 15 minutes. Malt diastase changed the starches and dextrins to maltose more rapidly in the presence of trypsin.

It is concluded that the starch of the wheat products was more easily digested than the starch of oats, and that consequently there is more reason for pre-cooking oats than wheat. The protein of the wheat endosperm was more easily digested than that of whole oats, whether precooked or not. Improvement in digestibility by longer cooking was greater for the protein than for the starch in all of the products, particularly the whole grain products.

The effect of diet on the copper content of milk, C. A. ELVEHJEM, H. STERNBOCK, and E. B. HART (*Jour. Biol. Chem.*, 85 (1929), No. 1, pp. 27-34).—Copper analyses are reported for samples of milk from individual cows and goats fed normal rations and the same supplemented with copper and for composite samples of milk obtained from herds of cows in various sections of the United States. Preliminary analyses having shown copper contamination from porcelain dishes, vitreous dishes were used for the analyses, which were conducted by the method of Elvehjem and Lindow (*E. S. R.*, 61, p. 612).

The average copper content of the milk of three cows was 0.154, 0.147, and 0.156 mg. per liter, and for the same cows after copper had been added to the ration 0.154, 0.137, and 0.143 mg. per liter. Corresponding figures for the milk of two goats were 0.156 and 0.137 mg. before and 0.155 and 0.130 gm. after the addition of copper to the ration. The copper content of the milk of cows in different sections of the country varied from 0.123 mg. per liter in North Carolina to 0.184 mg. in Texas, but the variations were so slight as to be considered of no significance.

It is noted that the figures for cow's milk are considerably lower than those reported by Quam and Hellwig (*E. S. R.*, 60, p. 491) and others reported in the literature. The authors are of the opinion that many of the high figures reported indicate copper contamination during analysis, particularly in the ashing process.

The South Carolina Food Research Commission: Preliminary report on its organization and activities, W. WESTON and R. E. REMINGTON (*Jour. Amer. Med. Assoc.*, 92 (1929), No. 26, pp. 2161, 2162, fig. 1).—This is a preliminary report on the organization and activities of a commission created in 1928 by the general assembly of South Carolina for the purpose of studying the mineral content of native food materials. The first element to be studied has been iodine, and a large number of samples of native-grown food materials have been analyzed for iodine by the simplified method of McClendon and Remington noted on page 807.

Tabulated data on the iodine content of eight vegetables show a much higher content of iodine than was reported by McClendon for the same vegetables grown in California and Oregon. Data are also reported on the iodine content of potatoes in different parts of the State. Contrary to the general belief that the normal source of iodine in the soil is from sea spray, the average iodine content of the samples analyzed appeared to increase with distance from the sea. Potatoes grown in the Piedmont region above the "fall line" contained more iodine than those grown below this line.

A preliminary study of the relation of diet to the development of goiter indicated that in only 4 of the 27 cases studied did vegetables enter into the diet.

The potato as an index of iodine distribution, R. E. REMINGTON, F. B. CULP, and H. VON KOLNITZ (*Jour. Amer. Chem. Soc.*, 51 (1929), No. 10, pp. 2942-2947, fig. 1).—Iodine determinations by the simplified method noted on page 807 are reported for 72 samples of potatoes from various parts of South Carolina and samples from Maine, Michigan, Minnesota, North Dakota, and Idaho. The maximum and minimum average values were 211 parts per billion on the dry basis for South Carolina and 86 for Minnesota, respectively. Large variations were found in samples from the same area and identical soil type, but the average values increased progressively from the sea to the Appalachian Mountains. The observation that the relative amount of clay in the soil increases in the same manner is thought to suggest that "the principal source of the iodine is from the disintegration of granite rocks, supplemented by the use of commercial fertilizers. The immediate influence of the sea is not seen beyond a very narrow belt along the coast."

Data are included on the iodine content of other vegetable foods in South Carolina, with corresponding data for a few of these materials from California and Oregon. The content of iodine in the South Carolina vegetables was very much higher than the reported analyses from the other States.

The essentials of chemical physiology, W. D. HALLIBURTON, J. A. HEWITT, and W. ROBSON (*London and New York: Longmans, Green & Co.*, 1929, 12 ed., pp. XII+383, [pl 1], figs. [55]).—This is a revised and somewhat enlarged edition (E. S. R., 49, p. 358).

The Scottish milk-feeding investigation in schools, J. B. ORR and G. LEIGHTON (*Jour. State Med.*, 37 (1929), No. 9, pp. 524-527).—A brief account of an investigation which has been noted previously from other sources (E. S. R., 61, p. 587).

The undernourished child of school age (*Jour. Amer. Med. Assoc.*, 94 (1930), No. 7, pp. 486, 487).—An editorial comment on the series of studies by Wang et al. (E. S. R., 62, p. 490).

The problem of chronic anorexia in childhood, F. W. SCHULTZ (*Jour. Amer. Med. Assoc.*, 94 (1930), No. 2, pp. 73-77).—In this address, delivered before the section on diseases of children at the 1929 meeting of the American Medical Association at Portland, Oreg., methods of treating functional anorexia in children were discussed. It was noted that the opportunities and possibilities of Aldrich's treatment (E. S. R., 57, p. 898) have generally been missed in the

older child brought to the physician for treatment. On account of this, methods to be followed in the treatment of children of preschool and school ages rather than infants were emphasized. In the author's opinion "the excessive consumption of cow's milk is not good for the child with anorexia, although it is always readily taken. In my experience, the single removal of this article of food from the diet has often caused a marked improvement in the anorexia and resulted in the better taking of other desirable foods." The discussion following the paper dealt chiefly with the recommendation of a quart of milk a day for the growing child, most of those taking part in the discussion being emphatically opposed to this recommendation.

The paper included a brief report of an experiment carried on by M. E. Dunshee at the Institute of Child Welfare of the University of Minnesota on factors affecting the amount and kind of food eaten by nursery school children.

A "bite" between meals (*Jour. Amer. Med. Assoc.*, 94 (1930), No. 7, pp. 487-488).—This editorial comment on the energy factor in nutrition deals chiefly with the report of Benedict and Farr noted previously (*E. S. R.*, 61, p. 890).

A study of the effects of certain diets upon the growth and form of albino rats, E. J. QUINN, C. G. KING, and B. H. DIMIT (*Jour. Nutrition*, 2 (1929), No. 1, pp. 7-18).—Comparisons are reported of certain body measurements of rats at corresponding ages on the Sherman diet 13, consisting of $\frac{1}{2}$ whole milk powder, $\frac{2}{3}$ whole wheat, and sodium chloride to the extent of 2 per cent of the wheat; diet 16, consisting of $\frac{1}{2}$ whole milk powder, $\frac{5}{8}$ whole wheat, and the same amount of sodium chloride; a vitamin A-free diet alone and supplemented by such amounts of whole milk powder as to permit of gains of 22 to 30 gm. in the 8-week period; and a vitamin B-free diet alone and supplemented with sufficient whole milk powder for maintenance and growth at a moderate rate.

On both the vitamin A- and vitamin B-deficient diets the body weights showed greater differences from the normal than the lengths of body and of legs, the chest girth, and the width of the hips. In proportion to the body length, the animals restricted in growth on diets low, but not completely lacking, in vitamin A had about the same chest girth and the same length of the long bones, with the exception of the humeri, as those on the normal diet (diet 13). The animals on diets low in vitamin B had smaller chests and longer leg bones relative to body length than normal animals of the same age. The humeri of the animals on the vitamin A-low diet were thicker in relation to length than normal, while those on the vitamin B-low diet were thinner than those of normal animals of the same age.

The rats on diets 16 and 13 were from stock which had been kept for generations on these diets for comparative purposes. The younger animals on the relatively inferior diet 16 in general showed longer leg bones relative to body weight than the diet 13 animals of the same age, but no appreciable differences with respect to weight. It is noted that these small differences in the bone and body structure of the rats on these two diets are in marked contrast to the much greater differences previously found in the life span, reproductivity, and resistance to lung infection of the animals on these two diets (*E. S. R.*, 60, p. 787).

The vitamin B and the vitamin G requirements of the albino mouse, F. C. BING and L. B. MENDEL (*Jour. Nutrition*, 2 (1929), No. 1, pp. 49-58, figs. 4).—In this investigation of the vitamin B (F) and G requirements of the mouse, young albino mice of the special inbred strain of Bagg were taken from their mothers between 3 and 4 weeks of age, placed in individual metal cages with wire screen false bottoms, and given a basal diet of purified casein

31, purified cornstarch 38, hydrogenated vegetable oil 24, and Osborne and Mendel salt mixture 7 per cent, with 2 drops of cod-liver oil per mouse per day. Various groups received, respectively, daily supplements of 200 mg. per mouse of dried yeast, 200 mg. of autoclaved yeast, an alcoholic extract of rice polishings (tikitiki), and 200 mg. of autoclaved yeast plus 2 drops, equivalent to 2 gm. of rice polishings, of undiluted tikitiki extract. The yeast was autoclaved by heating dried yeast in shallow pyrex dishes at 15 lbs. pressure for 4 hours. The tikitiki extract, when tested on rats, was shown to be a very potent source of the B factor and to contain very little of the G factor.

On the basal diet supplemented by autoclaved yeast alone all of the mice showed a small initial gain in weight and then a gradual decline, followed by death in about 21 days, while those receiving in addition 2 drops of tikitiki extract daily grew at a normal rate, as did those receiving untreated yeast. On a diet supplemented with tikitiki alone, an amount equivalent to 0.06 cc. of the original extract every other day proved sufficient to enable the mice to maintain their weight. This maintenance in the absence of added vitamin G was attributed to the presence of small amounts of G in the vitamin B preparations or to minute residues in the purified basal rations.

To determine the amount of tikitiki required as the sole source of vitamin B, with all other factors supplied, mice were kept on the basal ration plus 200 mg. daily of the autoclaved yeast plus 2 drops of cod-liver oil. The consumption of the yeast was kept up, but that of the food declined until at 2 weeks none was eating more than 0.5 gm. daily. When graded doses of tikitiki extract were then given all regained their appetite, and in 3 days the average food intake had increased to 5 gm. per mouse. The amount of tikitiki extract required for growth at rates considered normal was from 0.03 to 0.04 cc. daily as compared with 0.08 cc. for young rats of corresponding ages. This is thought to indicate that a growing mouse requires not more than half as much vitamin B (F) as a growing rat, while according to Beard (E. S. R., 55, p. 292) the growing mouse requires about as much of the vitamin B complex as does the growing rat or 4 times as much per unit weight.

The mice receiving tikitiki, but no source of vitamin G, showed no loss in appetite, but most of them developed skin lesions similar to those described in the literature for rats on the G-deficient diet. These lesions are described in detail.

"The uniformity of behavior of the individual animals on each diet and the general agreement with the results of rat experiments suggests the further use of mice for investigations of this character."

Report on the dietetic value of vitamin margarine (*Jour. State Med.*, 37 (1929), No. 9, pp. 541-549, figs. 4).—A brief report is given of the methods employed in the manufacture of an English brand of vitaminized margarine, and of comparisons of this margarine with representative samples of dairy butter for vitamin A content and with a sample of irradiated ergosterol for vitamin D content. The margarine was shown to compare favorably with butter in its content of vitamin A and to contain slightly less than 0.5 unit (British Pharmaceutical Society) of vitamin D per gram.

The development of the suckling young of milk fed rats, A. L. DANIELS, D. JORDAN, and M. K. HUTTON (*Jour. Nutrition*, 2 (1929), No. 1, pp. 19-29).—Recent literature on the vitamin B requirements for lactation is reviewed, and experiments are reported in which rats which had been kept on the usual stock diet were transferred to milk diets just before or following parturition. The diets included raw, boiled, pasteurized, and irradiated boiled milk and

several superheated milk preparations. In some cases substances rich in the antineuritic vitamin were added. The litters were all reduced to four soon after birth. The criteria of efficiency of the food were the average gain per rat per week between the fourth and twenty-second day and the percentage of weight gain or loss in the mother during the lactation period.

The summarized data show considerable variation in the growth of the young, as well as in the gain or loss in weight of the mothers. The addition of yeast, either autoclaved or nonautoclaved, was without significant influence on the development of the young. No relation could be detected between the gain in weight of the young and the loss of weight of the mother.

The authors conclude that "the less-than-optimum growth in some of the suckling young of the milk fed groups is not due to a deficiency of the antineuritic vitamin in the milk secretion, but to the inability of the particular rat to ingest a sufficient amount of milk to meet its caloric requirements, or to a general distaste for the food so that too little is eaten."

Cow's milk as a source of vitamin B for lactation, B. SURE (*Science*, 70 (1929), No. 1824, pp. 583, 584).—The investigation of Daniels et al. noted above is criticized (1) because the lactating rats were not depleted of vitamin reserves before using the test materials, (2) because in place of a diet complete in every respect except for vitamin B milk was used as the sole diet for lactation, and (3) because 4 young were used in place of the customary 6. "Since 7 to 8 young is the average size of a litter of the albino rat, 6 young would certainly be a more accurate and severer test than 4 young. The conclusion of Daniels et al. that 'it would seem that any food which can furnish enough of the antineuritic vitamin for the development of 4 suckling rats must contain enough for the normal human infant' has no basis for consideration. Although the young rat grows about 25 times as fast as the baby, the baby weighs about 650 times as much as the rat at birth, and approximately 300 times as much as the rat at weaning."

In connection with the criticism of the basal diet, another investigation of Daniels and coworkers (*E. S. R.*, 62, p. 294) is similarly criticized because of multiple deficiencies in the basal diet.

The effect of vitamin deficiencies on carbohydrate metabolism.—II, The influence of uncomplicated vitamin B deficiency on concentration of true sugar, reducing non-sugar, and alkaline reserve in the blood of the albino rat, B. SURE and M. E. SMITH (*Jour. Biol. Chem.*, 84 (1929), No. 2, pp. 727-740, figs. 3).—The investigation previously noted (*E. S. R.*, 61, p. 697) has been extended to weaned and adult rats. The method recently described by Somogyi (*E. S. R.*, 62, p. 408) for removing nonfermentable reducing substances, together with the proteins, was adopted with Folin's modified micro-ferricyanide method for subsequent determination of the sugar. With this differentiation of apparent from real sugar, it was found that the hyperglycemia frequently encountered in vitamin B (F) deficiency is in the apparent but not in the true sugar, i. e., the disturbance is in the reducing nonsugars. In 10 out of 15 rats suffering from vitamin B deficiency there was a marked increase in reducing nonsugars, but no disturbance in the concentration of the true sugar until the latter stages of the avitaminosis associated with prolonged inanition. In attempts to explain the difference between these results and those previously reported for nursing young (progressive hypoglycemia), the possibility is suggested that the insufficient food intake of the mother resulted in insufficient carbohydrate available to the young for the production of a normal blood sugar concentration.

Evidence was also obtained of the lowering of the alkali reserve in the later stages of vitamin B deficiency. Observations on the water intake during B

avitaminosis showed a reduction of from 13 to 18 per cent per 100 gm. of body weight, although in relation to food intake there was an increase of from 8 to 12 per cent. "Our conclusions are that the reduction in the water intake during uncomplicated vitamin B deficiency is positively a factor contributing to anhydremia, but the peculiar behavior of a number of animals in their comparatively greater water than food intake in the premortal state of polyneuritis would suggest that another as yet unidentified factor is also exerting an influence on the production of concentrated blood."

Vitamin B deficiency in nursing young rats and learning ability. S. MAUREE and L. S. TSAI (*Science*, 70 (1929), No. 1819, pp. 456-458).—This report deals with the number of trials required to learn a standard maze by 71 first generation rats, some of which were depleted of their vitamin B reserves during the nursing period by the method described by Sure (E. S. R., 61, p. 696). The controls and some of the depleted rats were started on the experiment at 70 days and the remainder at 90 days. The incentive to running the maze was a vitamin B concentrate. After a week of preliminary training in the food box the animals ran the maze once daily during the first 3 days, after which two trials a day were given until the problem was learned. The average number of trials required for the depleted animals tested at 70 and 90 days were 92 and 76, respectively, as compared with 31 for the normal animals tested at 70 days. None of the depleted animals except 3 of the 90-day-old group ever reached the attainment of the median of the normal group. These results are thought to be significant in comparison with previous findings of J. E. Anderson and A. H. Smith, indicating that rats fed on diets containing incomplete protein or insufficient calories are superior to normal rats in maze learning.

Technique for determination of the antineuritic vitamin B. H. M. EVANS and S. LEPKOVSKY (*Jour. Nutrition*, 2 (1929), No. 1, pp. 1-5, figs. 2).—Average growth curves are given for rats on diets devoid of vitamin B (F), but varying in the amount of protein, kind and amount of carbohydrate, and the amount of fat, and on the same diets supplemented by 50 mg. per rat per day of brewer's yeast as the source of vitamin B.

In the first group the poorest growth was obtained on a diet, consisting of extracted casein 20, sucrose 70, McCollum salt mixture (155) 4, and autoclaved yeast 10 parts. Little or no improvement resulted from replacing 10 per cent of the sucrose by the same amount of lard. The substitution of dextrinized cornstarch for the sucrose resulted in slight improvement in growth, and this was further enhanced by replacing 10 per cent of the starch with lard. Increasing the protein to 50 and 75 per cent of the diet resulted in progressive improvement in growth, and the best growth of all was secured with casein 36, salts 4, autoclaved yeast 10, and lard 50 parts. On this diet moderately good growth was secured and the animals remained in fairly good condition for 6 months with no added vitamin B.

In the second group similar differences were noted. The response to the same amount of yeast varied with the nature of the diet. Since the poorest growth was again secured on the diet containing 20 parts of casein and 70 of sucrose, it was concluded that this is the most suitable diet for the study of this vitamin.

An application of some of the more recent methods of estimating vitamin D. V. G. HELLER and C. CASKEY (*Jour. Nutrition*, 2 (1929), No. 1, pp. 59-65, figs. 5).—A careful examination of the methods of Jephcott and Bacharach and of Poulsson and Lövenskiöld for determining vitamin D' (E. S. R., 59, p. 293)

² *Jour. Compar. Psychol.*, 6 (1926), No. 5, pp. 337-359, pls. 2, figs. 5.

has led to the conclusion that the former, while of little value in determining the relative potency of two preparations of only slightly different potency, is useful in combination with the Poullsson method to indicate the proper time for beginning X-ray exposures. Certain changes in technic for both methods are described.

Cereals and rickets.—II, Antirachitic activation of cereals, H. STEENBOCK, B. RIISING, A. BLACK, and B. THOMAS (*Jour. Amer. Med. Assoc.*, 93 (1929), No. 24, pp. 1868-1874, figs. 4).—In continuation of the investigation previously noted (*E. S. R.*, 57, p. 898), several cereal products were rendered antirachitic by irradiation and tested for activity after various treatments. The activity was not destroyed by autoclaving for 30 minutes at 15 lbs. pressure, followed by drying at 60° C. for a few days or by storage at 60° or lower for 16 months or as long as the material remained palatable. Household cooking did not decrease the antirachitic action. Nonirradiated and commercially irradiated rolled oats were tested for antirachitic activity on dogs and rats, and commercially irradiated muffets and farina after varying periods of storage and in different dilutions with nonirradiated cereals. In all of the tests with commercially irradiated cereals less than maximum calcification was obtained on rations in which only one-fourth of the cereal had been irradiated. A ration in which all of the cereals (constituting 63.5 per cent of the ration) was irradiated was fed to rats through four generations, with no evidence of any harm.

The standard adopted for the vitamin D potency of commercially irradiated cereals is "that degree of activity which will allow normal bone production when fed as the sole source of cereal in our ration 2965, but not when diluted with 3 parts of untreated cereal. This keeps the cereal definitely in the food class and does not make it a medicine. In other words, it makes it definitely of hygienic value but not generally efficient as a curative agent."

The curative action of whole dried milk and sweetened condensed milk on experimental rickets in rats [trans. title], L. RANDOIN and R. LECOQ (*Jour. Pharm. et Chim.*, 8. ser., 10 (1929), No. 11, pp. 496-500, pl. 1).—Dried milk and sweetened condensed milk, fed exclusively to young rats rendered rachitic on the diet previously described (*E. S. R.*, 60, p. 197), brought about recalcification of the bones in six days as determined by X-ray examination.

The problem of the large scale control of rickets in the clinic [trans. title], H. VOLLMEYER (*Deut. Med. Wchnschr.*, 55 (1929), No. 45, pp. 1882-1884, figs. 2).—In a Berlin children's clinic a comparative study was made from November, 1928, to May, 1929, inclusive, of the effectiveness in the prophylaxis of rickets of the use of cod-liver oil, Radiostol, irradiation, and Biovinzwieback (a zwieback containing 2,000 antirachitic units of irradiated ergosterol). The number of cases in which the different materials were used and the percentage of complete protection in each were as follows: Cod-liver oil 64 and 14.1 per cent, Radiostol 84 and 26.2, irradiation 24 and 33.3, and Biovinzwieback 32 and 65.6 per cent. The surprisingly high results with Biovinzwieback are attributed to a greater constancy in its use through its being considered a food by the mothers of the children brought to the clinic.

Experimental study of irradiated ergosterol [trans. title], C. LEVADITI and L. Y. Po (*Presse Méd. [Paris]*, 38 (1930), No. 11, pp. 168-172, figs. 15).—This report of an investigation of the effect of massive doses of irradiated ergosterol on mice, rabbits, kittens, monkeys, and chickens is of particular interest in that evidence is given, with colored illustrations, of tissue sections of calcification in various organs induced by excessive doses of irradiated ergosterol.

While doses much larger than would ever be used therapeutically were without harmful effect, massive doses occasionally but not always resulted in cal-

cification in certain tissues. In general this tendency was accentuated at the site of preexisting lesions such as in tuberculosis and encephalitis. The authors are of the opinion that by means of irradiated ergosterol it may be possible to determine experimentally the mechanism of certain morbid processes involving calcification.

The action of E vitamin and ovarian function [trans. title], A. SZARKA (*Pflüger's Arch. Physiol.*, 223 (1929), No. 4-5, pp. 657-662).—The administration of various vitamin E preparations to rats from 3 to 5 weeks of age by feeding or subcutaneous injection brought on oestrus in 19 out of 29 cases, while 13 control animals of the same age were negative. The materials tested consisted of the ether extract, the unsaponifiable fraction, and the sitosterol-free unsaponifiable fraction of wheat embryo.

It is suggested that vitamin E may be a foundation material for the ovarian hormone or may act as a stimulus for the ovary.

MISCELLANEOUS

Forty-first Annual Report [of Arkansas Station], 1929, D. T. GRAY ET AL. (*Arkansas Sta. Bul.* 246 (1929), pp. 80, figs. 17).—This contains the organization list, brief summaries of the chief lines of work of the station, and a financial statement for the fiscal year ended June 30, 1929. The experimental work reported not previously noted is for the most part abstracted elsewhere in this issue.

[Papers from the Oklahoma Panhandle Station] ([*Oklahoma*] *Panhandle Sta., Panhandle Bul.* 14 (1930), pp. 14).—In addition to three articles abstracted elsewhere in this issue, the building and maintenance of lawns is discussed (pp. 3-6) by F. P. Eshbaugh.

NOTES

California University and Station.—Dr. George H. Hart, head of the division of animal husbandry, has been granted six months' leave of absence beginning July 1 for study in Europe, partly on mineral metabolism in livestock and deficiency troubles resulting from insufficient intake of mineral elements and vitamins at the Rowett Research Institute. Dr. F. M. Hayes, associate professor of veterinary science and veterinarian, has been granted leave for the same period and will spend approximately three months in a study of contagious abortion at the University of Giessen.

Michigan College and Station.—A new program of organization was approved by the State board of agriculture on April 4 following two years of study. A graduate school was established as a division of the college and with Dr. E. A. Bessey, head of the department of botany, as dean. Dr. Marie Dye, acting dean of the division of home economics, has been appointed dean.

Peter M. Harwood, professor of agriculture and agriculturist in the station from 1892 to 1894, died April 4 at Worcester, Mass., at the age of 76 years. He was a graduate of the Massachusetts College and from 1901 to 1923 general agent of the dairy bureau of the Massachusetts State Department of Agriculture.

Texas Station.—At its recent session the State legislature appropriated funds for the establishment of four additional substations. The board of directors has authorized the acceptance of a site for one of these stations at Winter Haven in the winter garden region, about midway between Carrizo Springs and Crystal City. The proposed site of 192 acres of land, grubbed, fenced, and equipped with motor-driven pump and connection, is being donated by citizens of the region, sponsored by the Winter Garden Chamber of Commerce. E. Mortensen, formerly county agent of Frio County, has been appointed superintendent of the new substation, and Sidney H. Yarnell, who is completing work for his doctor's degree at the Bussey Institution, has been appointed horticulturist, beginning July 1.

The legislature also appropriated \$17,500 for the purchase of a tract of land in east Texas to be used as a station for soil erosion studies to be conducted in cooperation with the United States Department of Agriculture. The Tyler Chamber of Commerce has donated approximately \$2,000 to supplement this appropriation, and a tract of 454 acres of land selected by representatives of the Department and the station as suitable for soil erosion studies has been acquired by the State and operations initiated. The acreage secured is believed to be sufficient to allow for the development of a comprehensive program in soil improvement as well as soil erosion.

Dr. Bruce L. Warwick, formerly assistant professor of veterinary science in the Wisconsin University and Station, was appointed on March 1 animal husbandman in charge of breeding investigations vice Dr. Jay L. Lush, who had resigned to accept a position with the Iowa College. Dr. Erwin Jungherr, for a number of years engaged in a study of sheep and goat diseases in Montana, has succeeded Dr. E. A. Tunnicliff, resigned, as veterinarian at the Ranch Experiment Station near Sonora. Under a cooperative arrangement with the U. S. D. A. Bureau of Animal Industry, Dr. Frank P. Mathews, assistant veterinarian in the Purdue Station, has been appointed veterinarian in charge of the loco investigations laboratory to be established in the Marfa-Alpine-Fort Davis territory.

INDEX OF NAMES

Aarnio, B., 118.
 Abbott, E. V., 536.
 Abbott, O. D., 392, 397.
 Abel, O., 446.
 Aberle, S. B. de, 324.
 Abjornson, El., 838.
 Achundow, J., 648.
 Ackerson, C. W., 766.
 Ackert, J. El., 467, 566.
 Adachi, S., 514, 620.
 Adam, N. K., 606.
 Adams, J. F., 440, 746.
 Adams, S. F., 189.
 Adams, W. L., 121.
 Adkin, R., 453.
 Adolph, W. H., 191.
 Adowa, A. N., 450.
 Adrianov, A. P., 650.
 Agruss, M. S., 608.
 Ahmann, C. F., 394.
 Aichholz, S. F., 768, 769.
 Aida, T., 621.
 Ainslie, C. N., 548.
 Akazawa, S., 167, 260.
 Alam, M., 622.
 Alberts, H. W., 26, 115, 127,
 137, 160, 165, 179, 199.
 Albrecht, W. A., 16, 17, 226,
 518, 797.
 Alden, C. H., 357, 653.
 Alder, H. El., 100.
 Aldous, A. El., 131.
 Alexander, A. S., 260.
 Alexander, C. P., 649.
 Alexander, J., 420, 801.
 Alexander, L. M., 90, 499.
 Alexander, W. H., 610.
 Alicata, J. El., 381, 563, 670.
 Allard, H. A., 404.
 Allen, C. C., 504, 505.
 Allen, C. R., 186.
 Allen, E., 125, 126, 324, 423.
 Allen, E. W., 4, 88, 200.
 Allen, F. W., 230.
 Allen, H. B., 503.
 Allen, J. R., 575.
 Allen, R. F., 745.
 Allen, W. M., 126.
 Allgeier, R. J., 14.
 Allison, F. E., 509.
 Allman, S. L., 854.
 Alp, H. H., 868.
 Alpatov, W. W., 650.
 Alquier, J., 597.
 Alterburg, El., 124, 512.

Alvarez, W. C., 189.
 Alvord, C. M., 505.
 Alway, F. J., 831.
 Amanschouloff, S. A., 170.
 Amburgey, L. V., 360.
 Ames, C. T., 31, 56, 127.
 Amirashvili, E. A., 242.
 Amos, J., 51.
 Anderson, A., 632.
 Anderson, A. K., 313, 380.
 Anderson, E. El., 257.
 Anderson, El. O., 376.
 Anderson, El. W., 346, 749.
 Anderson, I. A., 816.
 Anderson, J. C., 316.
 Anderson, L. C., 525, 740.
 Anderson, N., 890.
 Anderson, P. J., 831, 832,
 833.
 Anderson, R. J., 9.
 Anderson, W. E., 291.
 Anderson, W. S., 38, 632.
 Anderssen, F. G., 433.
 Andrade, R. d', 277.
 André, M., 548.
 Andrew, R. L., 312.
 Andrewes, H. El., 852.
 Andrews, El. A., 159, 861.
 Andrews, J. B., 385.
 Ané, J. N., 298.
 Angell, H. R., 237.
 Anker, J., 827.
 Annett, H. El., 662.
 Annin, G. El., 554.
 Anthony, El. L., 663.
 Anthony, R. D., 81, 229, 338.
 Antropov, V., 522.
 Antropovy, V., 522.
 Aragao, H. de B., 249.
 Arakawa, S., 118.
 Arant, F. S., 758.
 Arbousoff, 170.
 Arceneaux, G., 333.
 Archibald, J. G., 131, 257,
 663.
 Arens, H., 681.
 Armentrout, W. W., 887.
 Armstrong, E. A., 240.
 Armstrong, S. F., 130.
 Armstrong, T., 541.
 Arnold, G., 861.
 Arnquist, I. F., 598.
 Arny, A. C., 330.
 Aron, M., 515.
 Arrow, G. J., 852.

Arthold, M., 140.
 Arthur, J. C., 47.
 Arzoomanian, S., 112.
 Asbury, S. E., 213.
 Ascoli, M., 563.
 Asdell, S. A., 29, 664.
 Ashby, A. W., 885.
 Ashe, W. W., 844.
 Ashenberger, A., 209.
 Ashner, M., 774.
 Ashton, L. O., 594.
 Atkins, W. R. G., 611.
 Atkinson, A., 8.
 Atwood, H., 663.
 Auchter, E. C., 228, 526, 638.
 August, A., 598.
 Augustine, D. L., 167.
 Aumonier, F. S., 532.
 Aurivillius, C., 852.
 Averell, J. L., 531.
 Avinoff, A., 647.
 Ayres, W. E., 127.
 Ayyangar, C. R., 536.
 Ayzer, P. N. K., 853.
 Azbe, V. J., 275.
 Azevedo Marques, L. A. de,
 155.
 Azov, Z., 243.
 Azzi, G., 314, 403, 404.
 Babcock, E. B., 697, 723, 735.
 Babcock, K. W., 453.
 Bach, F. W., 448.
 Bacharach, A. L., 296.
 Bachmann, F., 122.
 Bacon, S. R., 715.
 Baer, J., 431.
 Baerg, W. J., 648, 851.
 Bagg, H. J., 215.
 Bagnall, R. S., 853.
 Bailey, C. E., 549, 637.
 Bailey, C. H., 489.
 Bailey, D. L., 799.
 Bailey, E. M., 100, 418, 832.
 Bailey, V., 446.
 Bain, J. B., 782.
 Bain, R., 890.
 Baird, A. B., 541.
 Baird, R. W., 78.
 Baird, W. W., 549, 637.
 Baker, A. D., 242.
 Baker, B. M., jr., 169.

- Baker, D. W., 260.
 Baker, F. S., 531.
 Baker, H. J., 89.
 Baker, H. R., 772.
 Baker, J. R., 30.
 Baker, L., 794.
 Baker, L. C., 112.
 Baker, M. S., 219.
 Baker, W. W., 540.
 Bakó, G., 241.
 Balachowsky, A., 155, 544.
 Balbach, P., 834.
 Balderston, R. W., 555.
 Balduf, W. V., 250, 545.
 Baldwin, R. L., 134.
 Baldwin, S. P., 447.
 Ball, G. J., 845.
 Ball, T. R., 608.
 Ballantyne, S., 549, 637.
 Ballinger, R. A., 573.
 Ballou, F. H., 40, 41.
 Ballou, H. A., 647.
 Balmuseda, J. C., 484.
 Banash, J. I., 275.
 Banerji, I., 520.
 Bang, O., 550.
 Baranoff, B., 249.
 Barber, G. W., 757.
 Barbier, A., 564.
 Barker, B. T. P., 532, 533.
 Barker, J., 850.
 Barker, R. H., 581.
 Barlow, O. W., 596.
 Barnes, H. F., 357, 553.
 Barnes, R., 772.
 Barnes, T. C., 648.
 Barnhart, E. W., 136.
 Barr, H. T., 879.
 Barre, H. W., 696.
 Barron, J. H., 130.
 Barron, N. S., 268.
 Bartel, F. O., 209.
 Bartels, M., jr., 539.
 Bartholomew, E. T., 722.
 Bartholomew, R. P., 225, 511, 814, 817, 819.
 Bartlett, J. M., 160, 508.
 Barton, L. V., 640, 844.
 Barton, O. A., 553.
 Basinger, A. J., 448, 449.
 Bass, C. C., 670.
 Basset, J., 566.
 Bates, E. N., 134.
 Baudys, E., 538.
 Bauer, F. C., 118, 212, 315, 316, 328, 716.
 Baylor, A. S., 89, 186.
 Beach, J. R., 300, 471, 473.
 Beach, W. S., 347.
 Beadle, A. P., 90.
 Beadles, J. R., 362, 391.
 Beamer, E. A., 682.
 Beamer, R. H., 245.
 Bean, L. R., 283.
 Beard, C. A., 580.
 Beard, F. J., 549.
 Beard, H. H., 695.
 Beattie, W. R., 340.
 Beaudeite, F. R., 377, 472, 565, 670, 671.
 Beaufort, L. F. de, 539.
 Beaulne, J., 242.
 Beaumont, A. B., 130.
 Beaumont, J. H., 525.
 Beaupaire Aragao, H. de, 249.
 Bechdel, S. I., 370.
 Bechtel, L. E., 555.
 Beck, P. G., 387.
 Beck, W. A., 616.
 Becker, R. B., 463.
 Beckett, S. H., 777.
 Beckett, W. H., 518, 519.
 Beckley, V. A., 672.
 Beckwith, C. S., 756, 853, 855.
 Bedenbaugh, P. G., 63.
 Bednarikova, J., 278.
 Begtrup, H., 187.
 Belavsky, A. G., 250.
 Bell, C. C., 672.
 Bell, D. S., 62, 63.
 Bell, E. J., jr., 300.
 Bell, E. W., 282.
 Belschner, H. G., 558.
 Belton, H. L., 384, 776.
 Bemis, K. P., 222.
 Bender, C. B., 554.
 Benedict, F. G., 192, 597.
 Benedict, M. R., 573.
 Benloch, M., 147, 237.
 Benner, J. W., 260, 470.
 Bennett, C. A., 186, 274.
 Bennett, E., 200.
 Bennett, J. B., 178, 885.
 Bennett, J. P., 743.
 Bennett, M. K., 181, 888.
 Bennett, S. C. J., 77, 263.
 Bennett, W. J., 209.
 Benoit, C., 807.
 Benoy, M. P., 584.
 Benton, A. G., 9, 871.
 Bequaert, J., 649.
 Beresford, H., 275.
 Beresford, R., 499.
 Beretta, H., 487.
 Bereza, W., 121.
 Berg, C. P., 191.
 Bergey, D. H., 821.
 Bergsmark, D. R., 313.
 Bergtold, W. H., 447.
 Berkeley, G. H., 148, 527.
 Bernard, J., 890.
 Bernheimer, W. E., 505.
 Bernstine, J. B., 560.
 Berry, L. N., 257.
 Bertram, F. E., 520.
 Bertram, K., 800.
 Bertram, S. H., 207.
 Bessey, E. A., 900.
 Bethke, R. M., 461.
 Betten, C., 200.
 Betts, M. C., 81.
 Betts, P. L., 681.
 Bevan, W. L., 200.
 Bewley, W. F., 130.
 Biedrzycki, E., 276.
 Bieltzer, A. W., 548.
 Bierring, W. L., 169.
 Biester, H. E., 878.
 Bigger, J. H., 330, 352.
 Billeau, A., 277.
 Bills, C. E., 693.
 Bing, F. C., 894.
 Binkley, A. M., 644.
 Binney, T. H., 665.
 Bioletti, F. T., 697, 735.
 Birch, R. R., 260.
 Birchard, F. J., 429.
 Bisby, G. R., 47.
 Bishop, G. H., 648.
 Blissell, T. L., 241.
 Bissrup, A., 209.
 Bissonnette, T. H., 325.
 Bitler, R. O., 834.
 Bittenbender, H. A., 275, 552.
 Bittner, J. J., 216.
 Bixby, E. M., 190.
 Black, A., 893.
 Black, J. D., 884.
 Black, L. M., 80.
 Black, O. F., 376.
 Black, R. H., 427, 477.
 Black, W. R., 611.
 Blackaby, J. H., 175.
 Blackberg, S. N., 298.
 Blackman, V. H., 611, 612.
 Blair, J. C., 335.
 Blair, K. G., 852.
 Blair, W. S., 549, 836.
 Blake, D., 809.
 Blake, M. A., 429.
 Blanchard, M., 169.
 Blanck, E., 501.
 Bland, L. J., 324.
 Blaney, H. F., 777.
 Blaney, J. E., 121.
 Blasingame, R. U., 382.
 Blaskovics, A., 487.
 Blattný, C., 536.
 Blauvelt, W. E., 740.
 Bleecker, W. L., 773, 874.
 Bleyer, R., 800.
 Blish, M. J., 288, 489, 766.
 Bliss, R. K., 6.
 Blount, E. H., 200.
 Bloxson, A. P., 397.
 Blumenfeld, C. M., 197.
 Blunck, H., 535.
 Boak, R. A., 260, 773.
 Bobby, F. C., 461.
 Bodenberger, E. T., 122.
 Bodenheimer, F. S., 450, 539.
 Bodkin, G. E., 853.
 Bodman, G. B., 717.
 Bodnar, G. P., 134.

- Boegehold, A. L., 881.
 Boehm, G., 397.
 Boerner, E. G., 81.
 Bogardus, E. S., 580.
 Böhm, E., 311.
 Bohstedt, G., 367, 499.
 Bois, D., 321.
 Bolla, G., 276.
 Bolle, P. C., 57.
 Bond, M. C., 782.
 Bonde, R., 223, 632.
 Böning, K., 49, 450.
 Bonnet, J. A., 797.
 Bonney, V. B., 787.
 Bonnier, G., 726.
 Boord, C. E., 272.
 Booth, E. G., 428.
 Bordeleau, R., 637.
 Borden, A. D., 751.
 Bordner, J. S., 532.
 Borelli, A., 852.
 Borgmeier, F. T., 858.
 Bornstein, H., 881.
 Borodaevskij, P., 243.
 Borodaevskij, P., 243.
 Borodin, D. N., 650.
 Bos, H., 409.
 Bose, B. D., 431.
 Boselli, F. B., 154.
 Bosley, H. L., 882.
 Boss, A., 500.
 Bosvieux, J., 836.
 Boswell, V. R., 339, 340.
 Bosworth, T. L., 562.
 Bottel, A. E., 358.
 Bottimer, L. J., 156.
 Bottorff, C. A., 472.
 Boucher, R., 9.
 Boughton, D. C., 267, 514.
 Boulter, J. W., 223.
 Bouquet, A. G. B., 836.
 Bourdillon, R. B., 114.
 Bourne, A. I., 245.
 Bouvier, E. L., 650.
 Bouyoncos, G. J., 20, 410.
 Bowen, P. R., 618.
 Bowers, F. A. I., 437.
 Bowie, E. H., 209, 808.
 Bowie, M. A., 191.
 Bowling, J. D., Jr., 721.
 Bowman, J. J., 51.
 Bowman, N. A., 550.
 Box, H. E., 457.
 Boyce, A. M., 455.
 Boyce, E. F., 213, 760.
 Boyd, A. G., 668.
 Boyd, J. D., 491, 595.
 Boyd, O. C., 698, 745.
 Boyd, T. A., 882.
 Boyd, W. L., 263, 562, 699.
 Boyle, C., 700.
 Boynton, W. H., 561.
 Brackett, E. E., 300.
 Bradbury, D., 435.
 Bradfield, R., 17.
 Bradford, F. C., 484.
 Braman, W. W., 656.
 Brancovich, E. M., 276.
 Brandly, C. A., 670, 776.
 Brandt, P. M., 870.
 Branham, S. E., 875.
 Brannen, C. O., 885.
 Brannon, J. M., 872.
 Braune, G. M., 473.
 Braune, R., 859.
 Bray, R. H., 13, 315, 811.
 Brdlik, V., 276, 277.
 Breaky, E. P., 856.
 Breed, R. S., 10, 73, 555, 770.
 Bregger, T., 600.
 Breithaupt, L. R., 181.
 Bremer, H., 449.
 Brentzel, W. E., 349.
 Bressman, E. N., 634.
 Bréthes, J., 155.
 Brew, J. D., 463.
 Bridges, A., 480.
 Bridges, C. B., 420.
 Buidré, J., 170.
 Brierley, 532.
 Brierley, W. G., 230.
 Briggs, F. N., 441, 745, 846.
 Brigham, G. D., 376.
 Brigl, P., 800.
 Brindley, J. E., 885.
 Brinkley, H. L., 681.
 Briod, A. E., 112.
 Briscoe, C. F., 31, 127, 506.
 Brittain, W. H., 242, 541.
 Britton, H. T. S., 707.
 Britton, W. E., 599, 647.
 Brock, A. A., 358, 449.
 Brock, J. H., 370.
 Brody, C. L., 682.
 Brody, S., 70, 797.
 Brongersma, L. D., 539.
 Brookens, P. F., 389.
 Brooker, M. A., 388.
 Brooks, A. J., 237.
 Brooks, A. N., 345.
 Brooks, C. C., 855.
 Brooks, C. E. P., 314.
 Brooks, C. F., 16, 808, 809.
 Brooks, C. P., 298.
 Brooks, F. E., 250.
 Brooks, F. P., 582.
 Brooks, P. B., 555.
 Brooks, S. D., 797.
 Brouwer, E., 165.
 Brown, B. A., 131.
 Brown, B. E., 36, 224.
 Brown, C. A. C., 173.
 Brown, E., 135.
 Brown, F. L., 88.
 Brown, G. A., 458.
 Brown, G. G., 570, 882.
 Brown, H. B., 694.
 Brown, L. N., 173.
 Brown, N. A., 347, 439.
 Brown, P. E., 19, 32.
 Brown, S. M., 819.
 Browne, C. A., 176.
 Browne, T. E., 682.
 Browning, H. M., 555.
 Bruce, E. A., 772.
 Brues, C. T., 647.
 Bruner, S. C., 542.
 Bruner, S. E., 555.
 Brunett, E. L., 260.
 Brunig, M. P., 275.
 Brunner, E. DeS., 580.
 Brunson, A. M., 427.
 Brunson, M. H., 855.
 Brunton, W., 424, 862.
 Bryan, A. A., 33.
 Bryan, H., 130.
 Bryan, M. K., 646, 849.
 Bryant, T. R., 200.
 Buchanan, D. S., 161.
 Buchanan, J. H., 871.
 Buchanan, R. E., 105.
 Buchanan, W. D., 706.
 Buck, A. de, 455.
 Buck, J. M., 876.
 Buckland, H., 196.
 Buckman, H. O., 82, 810.
 Bucknam, R. F., 780.
 Buckner, G. D., 68, 125.
 Buhôt, E. W. L., 857.
 Buie, T. S., 33, 221, 507.
 Buligan, C. T., 856.
 Bull, L. B., 167, 669.
 Bull, S., 363, 366.
 Bullard, W. P., 682.
 Bülow, F. W. v., 180.
 Bunyee, H., 471, 670, 879.
 Buonocore, A., 335.
 Burd, F. G., 187.
 Burdick, R. T., 281.
 Burgess, A. F., 356, 649.
 Burgess, C. F., 136.
 Burgess, P. S., 506.
 Burgess, E. E., 751.
 Burk, V. F., 247.
 Burke, E., 226.
 Burke, R. T. A., 317.
 Burlison, W. L., 329, 329, 382, 521.
 Burnett, E. A., 200.
 Burnett, W. L., 539.
 Burnham, D. R., 32, 331.
 Burns, C. C., 682.
 Burns, G. P., 232.
 Burns, K. Van A., 200.
 Burns, W., 425.
 Burnside, C. E., 649, 759.
 Burr, G. O., 292, 293.
 Burr, M. M., 292, 293.
 Burr, W., 582.
 Burr, W. W., 105.
 Burrill, M. F., 209.
 Burruss, J. A., 200, 580.
 Burt, H. J., 86, 580.
 Busck, A., 545, 855.
 Bushnell, J., 35, 222.
 Bushnell, L. D., 217, 472, 473, 670.

- Buster, M. W., 552.
 Butler, H. G., 753, 754.
 Butler, T., 681.
 Butovitsch, V. v., 450.
 Butt, N. I., 580.
 Button, F. C., 95, 465.
 Buxton, P. A., 853.
 Byers, G. B., 386.
 Caesar, L., 541.
 Caffrey, D. J., 647.
 Cain, C. B., 170.
 Cain, W., 475.
 Caldwell, G. W., 593.
 Calhoun, F. H. H., 88, 200.
 Call, A. H., 358, 448.
 Call, I. J., 84.
 Callaghan, A. R., 635.
 Callenback, E. W., 368.
 Calmette, A., 169.
 Calton, W. E., 865.
 Calvert, P. P., 650.
 Cambage, R. H., 820.
 Cambden, M. R., 197.
 Cambron, A., 805.
 Camburn, O. M., 284.
 Cameron, A. E., 772.
 Cameron, H. C., 192.
 Camp, A. F., 325, 334, 343.
 Campbell, F. L., 648.
 Campbell, J. M., 882.
 Campbell, M. V., 200.
 Campbell, R. C., 35.
 Candura, G. S., 154.
 Cañizo, J. del, 147.
 Cantacuzene, A. G., 277.
 Capó, B. G., 600.
 Cappelletti, C., 821.
 Capstick, J. W., 862.
 Card, L. E., 367, 552.
 Cardinell, H. A., 229.
 Carlyle, E. C., 718.
 Carman, J. S., 892.
 Carne, H. R., 558.
 Carodemos, P. P., 556.
 Carp, L., 260.
 Carpano, M., 566, 775.
 Carpenter, C. M., 260, 773.
 Carpenter, D. C., 606.
 Carpenter, E. J., 116, 713, 715.
 Carpenter, G. H., 853.
 Carpenter, I. P., 245.
 Carpenter, L. M., 606.
 Carr, M. S., 570.
 Carr, W. A. C., 862.
 Carrero, J. O., 720.
 Carrion, A. L., 858.
 Carroll, W. E., 365, 366, 500.
 Carter, C. W., 596.
 Carter, D. G., 177, 879.
 Carter, R. H., 653.
 Cartland, G. F., 516, 591.
 Cartwright, F. P., 672.
 Carughl, A., 609.
 Carver, J. S., 766.
 Caryl, R. E., 436.
 Case, H. C. M., 385, 386.
 Case, L. I., 756.
 Casida, L. E., 64.
 Caskey, C., 876, 897.
 Casman, E. P., 775.
 Castella, F. de, 246.
 Castetter, E. F., 43.
 Castle, W. B., 191.
 Castle, W. E., 323, 623.
 Catalá, J. V., 165.
 Catanel, A., 172.
 Cates, F. M., jr., 200.
 Cathcart, C. S., 60, 524, 721.
 Catherwood, M. P., 781.
 Catron, L. F., 693.
 Caulfield, W. J., 166, 465.
 Cavanaugh, G. W., 556.
 Cayeux, H., 421.
 Cayeux, L., 421.
 Cebeova, M., 649.
 Chace, E. M., 842.
 Chace, E. P., 200.
 Chaddock, R. E., 580.
 Challis, E. O., 166.
 Chamberlin, W. E., 667.
 Chamney, N. P., 713.
 Champlin, M., 220.
 Champy, C., 515.
 Chandler, S. C., 352.
 Chapline, W. R., 130.
 Chapman, J. E., 413.
 Chapman, P. J., 241, 859.
 Chapman, R. N., 241, 648, 699.
 Chase, A., 131.
 Chase, E. S., 808.
 Chaudhuri, H., 52.
 Cheesman, L. E., 853.
 Chen, T. T., 91.
 Cherian, M. C., 455, 457, 545.
 Chevalier, A., 529.
 Chick, H., 195.
 Child, A. M., 132.
 Childs, L., 649.
 China, W. E., 355.
 Chittenden, A. K., 438.
 Chorine, V., 249, 454.
 Christ, J. H., 19, 22, 77, 82.
 Christensen, C. L., 85.
 Christensen, J. J., 236.
 Christiansen, W. G., 112.
 Christie, G. I., 220.
 Chrystal, R. N., 359.
 Chung, H. L., 461, 685.
 Church, C. G., 842.
 Church, H. R., 555.
 Ciferri, R., 645.
 Ciomac, I. L., 276.
 Clair, E. L., 794.
 Clario, I. V., 852.
 Clark, F. M., 329.
 Clark, G. H., 185.
 Clark, J. A. (U. S. D. A.), 37, 134, 523.
 Clark, J. A. (Can.), 549, 637.
 Clark, J. H., 592.
 Clark, M. A., 797.
 Clark, M. L., 289.
 Clark, R. J., 489.
 Clark, S. W., 553.
 Clark, T., 92.
 Clarke, W. H., 855, 859.
 Clausen, J., 723.
 Clavell, C. J., 606.
 Clawson, A. B., 74.
 Clawson, R. M., 575.
 Clayton, B. S., 879.
 Clayton, E. E., 223, 748, 847.
 Clayton, E. P., 66, 163.
 Cleare, L. D., jr., 647.
 Clement, C. E., 770, 782.
 Clement, F. M., 481.
 Clément, R., 592.
 Clemmer, H. J., 32, 331.
 Cline, A. S., 615.
 Cline, J. A., 61, 288.
 Clinton, G. P., 838.
 Clinton (Lord), 862.
 Closs, C. P., 223.
 Closs, J. O., 190.
 Cloudman, A. M., 216.
 Clover, J. P., 130.
 Clow, B., 95, 588.
 Clyde, G. D., 209.
 Coad, B. R., 56, 647.
 Cobb, C. A., 682.
 Coblenz, W. W., 479, 592.
 Cochran, R. L., 474.
 Cockerell, T. D. A., 242.
 Coe, F. M., 838.
 Coffey, J. S., 499.
 Coffey, W. C., 187, 500, 696.
 Coffman, F. A., 35, 632.
 Cohee, C. I., 555.
 Cohen, B., 794.
 Cohen, J., 890.
 Colie, T. S., 641.
 Colby, A. S., 336, 347.
 Cole, G. M., 136.
 Cole, L. J., 123.
 Colebrook, D., 593.
 Coleman, J. M., 425.
 Coleman, M. B., 772.
 Coles, E. H., 331.
 Colizza, C., 154.
 Colla, S., 821.
 Collazo, J. A., 96.
 Collens, W. S., 398.
 Collin, J. E., 647.
 Collins, B., 355.
 Collins, C. W., 158.
 Collins, D. A., 687.
 Collins, G. N., 227.
 Collins, J. L., 723.
 Collins, S. D., 92.
 Collison, D. L., 206.
 Collison, R. C., 21.
 Colton, H. S., 625.

- Colvin, E. M., 179.
 Comas, J. N., 852.
 Combs, W. B., 463.
 Comin, D., 41, 42.
 Comish, N. H., 187.
 Compere, H., 57, 547, 757.
 Compton, C. C., 353.
 Conacher, H. M., 480.
 Condit, I. J., 734.
 Cone, W. H., 419.
 Conn, H. J., 21, 311, 731.
 Connaway, J. W., 73.
 Connell, W. E., 870.
 Conner, A. B., 696.
 Conrad, J. P., 273, 332, 727, 778.
 Constantinesco, G. K., 277.
 Conte, V., 154.
 Conway, H. M., 85.
 Cook, D. H., 583.
 Cook, H. T., 250.
 Cook, M. T., 129, 138, 146, 199.
 Cooley, C. H., 580.
 Cooley, R. A., 100.
 Cooley, R. L., 186.
 Coombs, W., 573.
 Coon, C. J., 472.
 Coons, G. H., 532.
 Cooper, H. P., 82, 130.
 Cooper, J. R., 828, 834, 835.
 Cooper, T. P., 8, 299.
 Cooper, W. J., 6.
 Copeland, L., 371.
 Corbett, R. B., 485.
 Corin, M. F., 884.
 Cornăţeanu, N. D., 276.
 Cornelius, J. T., 169.
 Corner, G. W., 126.
 Cornlea, F. A., 682.
 Corporaal, I. B., 649.
 Corporaal, J. B., 648.
 Corson, J. J., 3d., 185, 582.
 Cory, E. N., 157.
 Cosby, S. W., 713.
 Costa Lima, A. Da, 249.
 Cotton, R. T., 132, 250.
 Coughlin, C., 498.
 Coulson, J. G., 799.
 Coulter, J. L., 88, 700.
 Covault, C. H., 463.
 Coventry, F. A., 875.
 Coville, P., 438, 647.
 Cowan, D. R. G., 885.
 Cowan, F. T., 154, 854.
 Coward, K. H., 197, 589, 692.
 Cowden, H. A., 682.
 Cowell, S. J., 90, 587.
 Cowgill, H. B., 733.
 Cox, A. B., 572.
 Cox, R. F., 761.
 Cox, W. M., jr., 693.
 Coy, J. P., 358.
 Coyecque, M., 505.
 Coyle, F. B., 880, 882.
 Cracknell, R. J., 571.
 Craib, I. J., 530.
 Craig, G., 95.
 Craig, J. F., 876.
 Craigie, J. H., 443, 643.
 Crain, L. D., 200.
 Cram, E. B., 381, 474.
 Cramp, R. C., 467.
 Crandall, C. S., 335.
 Cranfield, H. T., 664.
 Crawford, C. H., 371.
 Crawford, C. W., 381.
 Crawford, D. L., 852.
 Crawford, H. G., 647.
 Creech, G. T., 470.
 Crespo, R. J., 569.
 Cresson, E. T., jr., 648.
 Creswell, M. E., 200.
 Criddle, N., 541.
 Crist, J. W., 193.
 Critz, P. F., 271.
 Crocheron, B. H., 795.
 Crocker, W., 640.
 Cromer, C. O., 314.
 Crosby, C. R., 740.
 Crosby, M. A., 35, 179.
 Cross, F., 562.
 Crossman, S. S., 356.
 Crouch, R. L., 73.
 Cruess, W. V., 489, 504, 787.
 Crump, T. W., 564.
 Cruz, M. M. de la, 134.
 Cugnac, A. de, 711.
 Cuillé, J., 467.
 Culp, F. B., 893.
 Culver, G. E., 487.
 Cummins, J. W., 632.
 Cunningham, G. H., 148.
 Cunningham, J. T., 29.
 Curran, C. H., 546.
 Currey, G. S., 820.
 Currin, R. E., 507.
 Curtis, H. E., 508.
 Curtis, V., 423.
 Cushman, E. M., 497.
 Cushman, H. E., 164.
 Cushman, R. A., 754, 860.
 Cutright, C. R., 540.
 Czvetkovits, F. de, 486.
 Dacey, H. G., 772.
 Da Costa Lima, A., 249.
 Dade, J., 264.
 Dahlberg, A. C., 769.
 Dahle, C. D., 258, 372, 373.
 Dailey, E. J., 462.
 Daingerfield, L. H., 808, 809.
 Dakan, E. L., 461.
 Dale, J., 394.
 Dalling, T., 170.
 Dam, W. van, 166.
 Dammerman, K. W., 538, 539.
 Damon, S. R., 876.
 Dampf, A., 647.
 d'Andrade, R., 277.
 Danforth, C. H., 30, 217.
 Daniel, F. M., 635.
 Daniels, A. L., 294, 393, 394, 895.
 Danielson, I. S., 111.
 Darraspen, E., 467.
 Darrow, G. M., 44, 140, 435.
 Daubney, R., 877.
 Davel, H. B., 465, 700.
 Davenport, C., 773.
 Davenport, E., 4.
 Davidson, J., 245.
 Davidson, S. F., 117.
 Davidson, W. M., 851.
 Davies, J. L., 885.
 Davies, W. M., 157.
 Davis, A. C., 752.
 Davis, A. R., 615.
 Davis, E. F., 799.
 Davis, F. L., 226, 452, 518.
 Davis, I. G., 276.
 Davis, J. G., 700.
 Davis, J. J., 186, 449.
 Davis, J. S., 235, 578, 884.
 Davis, M. B., 527.
 Davis, N. C., 856.
 Davis, R. L., 522, 731, 737.
 Davis, W. A., 713, 715.
 Davis, W. E., 135.
 Davison, W. F., 555.
 Dawbarn, M. C., 254.
 Day, E. L., 782.
 Day, W. P., 16, 809.
 Dayton, N. A., 625.
 de Aberle, S. B., 324.
 Deam, C. C., 213.
 Dean, A. L., 699, 816.
 Dean, G. A., 56, 647.
 Dean, L. A., 816.
 Dean, W. H., 178, 885.
 Deay, H. O., 245.
 de Azevedo Marques, L. A., 155.
 de Beaufort, L. F., 539.
 de Beaupaire, Aragão, H., 249.
 de Buck, A., 455.
 De Burle, H. M., 446.
 de Castella, F., 246.
 Decker, S. W., 337, 338.
 de Cugnac, A., 711.
 de Czvetkovits, F., 486.
 Deeter, E. B., 117.
 de Eza (Viscount), 276.
 de Fejérváry, G. J., 620.
 de Gryse, J. J., 611, 613.
 De Jankowska, S., 278.
 de Jong, J. K., 451.
 Dekhtiarov, N. S., 853.
 de la Cruz, M. M., 134.
 de la Huerta, A., 852.
 del Cañizo, J., 147.
 de Lépiney, J., 451.
 Delez, A. L., 263.

- de Lindequist, 486, 487.
 Delos, A., 486.
 De Meillon, B., 57.
 Demerec, M., 822.
 Demidenko, T., 219.
 DeMoll, R., 462.
 Denison, H. L., 342.
 Denison, I. A., 120.
 Denmead, T., 52.
 Dennett, R. H., 593.
 Denny, F. E., 228, 225.
 Dent, J. G., 174, 477.
 de Ong, E. R., 647.
 De Penha Garcia, J., 277.
 Derlitzki, G., 277.
 de Rooy, N., 539.
 Derrick, G. W., 260.
 de Ruyter de Wildt, J. C., 163.
 Desai, M. H., 548.
 DeSanctis, A. G., 594.
 Detjen, L. R., 735, 749.
 De Turk, E. E., 118, 314, 315, 316, 328, 716.
 Detwiler, C. S., 555.
 Detwiler, J. D., 541.
 Deuber, C. G., 618.
 Devereux, E. D., 503.
 Devereux, R. E., 117, 714, 715.
 de Villiers, F. J., 141.
 De Vuyst, A. M., 278.
 De Vuyst, P., 278, 486.
 Dewey, J., 580.
 de Wildt, J. C. de R., 163.
 d'Herelle, F., 875.
 Dickens, D., 111.
 Dickson, J. G., 236.
 Dickson, R. E., 270.
 Diehl, H. C., 230, 787.
 Diehm, R. A., 814.
 Dietrich, K. R., 311.
 Digges, J. G., 456.
 Dillman, A. C., 330, 427.
 Dimit, B. H., 894.
 Dingler, M., 450.
 Dinulescu, G., 858.
 Dmitrochenko, A. P., 253.
 Dmitrochenko, A. P., 253.
 Doan, F. J., 258, 873.
 Dobbins, H. S., 562.
 Dublin, H. E., 220.
 Dobresco, M. G., 278.
 Dobrosky, I. D., 645, 554.
 Dobzhansky, T., 422, 648.
 Dodds, H. H., 133.
 Dollfuss, E., 277.
 Dolloff, A. F., 454.
 Dominguez, F. A. L., 32, 42, 99.
 Domm, L. V., 325, 423.
 Donatien, A., 170.
 Doornbos, W. H., 455.
 Düpelhauer, 565.
 Doran, W. L., 440, 444.
 Dorcas, M. J., 593.
 d'Orchymont, A., 650, 852.
 Dörner, H. B., 338.
 Dornic, 277.
 Dorset, M., 670.
 Dorsett, P. H., 213.
 Dorsey, H., 131.
 Dorsey, M. J., 336, 513.
 Dorwagen, A. E., 276.
 Dossall, L., 645.
 Dossin, C. O., 471.
 Doteu, S. B., 55, 88, 99.
 Dougherty, J. E., 384, 776, 777.
 Doughy, 717.
 Douglass, J., 228.
 Dowler, J. F., 386.
 Downie, E. R., 682.
 Doyle, L. P., 172, 265.
 Doyle, T. M., 76, 776.
 Dozler, H. L., 455, 753, 754.
 Drabble, J., 187.
 Drabkin, D. L., 190.
 Drain, C. L., 491, 595.
 Drakeley, T. J., 870.
 Dreesen, W. H., 483.
 Drejer, A. A., 277.
 Driftmier, R. H., 384.
 Driggers, B. F., 156.
 Drottij, S., 227.
 Drummond, J. C., 112, 208.
 Drury, A. N., 596.
 Dubov, P. I., 799.
 Ducomet, V., 147.
 Dudley, J. E., jr., 649.
 Duffee, F. W., 275, 571, 572.
 Dugan, G. H., 352.
 Duke, A. M., 157.
 Dulac, J., 821.
 Dunbar, C. O., 47, 440.
 Duncan, L. N., 6.
 Duncan, O. D., 784.
 Duncker, H., 514.
 Dungan, G. H., 328, 346, 382, 519, 521, 759.
 Dunham, W. E., 656.
 Dunkin, G. W., 265.
 Dunn, H. L., 192.
 Dunn, L. H., 542.
 Dunnam, E. W., 358, 655.
 Dunnewald, T. J., 506.
 Dunshee, C. F., 334, 777.
 Durant, A. J., 73.
 Dürken, B., 213.
 Dustman, R. B., 131.
 Lntcher, R. A., 94, 396, 397.
 Duthie, R. C., 377.
 du Toit, P. J., 501, 863, 864.
 Dutt, C. P., 123.
 Droracheh, H. E., 869.
 Dwight, J. L., 546.
 Dye, M., 193, 900.
 Lyke, R. A., 809.
 Dykshorn, S., 516.
 Earnshaw, F. L., 240, 351.
 Earp, J. R., 592.
 Easterby, H. T., 522.
 Eastham, L. E. S., 648.
 Eastman, M. G., 334.
 Eaton, N. A., 799.
 Eaton, T. H., 685.
 Eckerson, S. H., 837.
 Eckles, C. H., 463, 554, 699, 767.
 Eckstein, H. C., 458.
 Eddy, C. O., 855, 859.
 Eddy, W. H., 93, 396, 607.
 Eden, T., 529.
 Edgar, G., 167, 467, 558.
 Edgerton, A. H., 186.
 Edington, J. W., 667.
 Edler, W., 220.
 Edmond, J. B., 138.
 Edmonds, C. R., 167.
 Edmundson, W. C., 224.
 Edwards, A., 143.
 Edwards, E. E., 53.
 Edwards, F. W., 648, 853.
 Edwards, H., 798.
 Edwards, P. R., 268, 269, 471, 878.
 Edwards, S. J., 668.
 Effatoun, H. C., 649.
 Eggleston, W. W., 376.
 Eheart, J. F., 164.
 Eidmann, H., 449, 450, 648.
 Einset, O., 738.
 Eiserson, L., 789.
 Eke, P. A., 276, 678.
 Eklund, E. E., 505.
 Elazari-Volcani, I., 181, 890.
 Elden, H. Van, 723, 734, 735.
 Elford, F. C., 869.
 Elkes, A., 800.
 Ellenberger, H. B., 252, 258, 259.
 Ellenwood, C. W., 40, 41.
 Ellett, W. B., 164.
 Elliott, F. F., 573.
 Elliott, F. J., 682.
 Elliott, H. G., 426.
 Ellis, B. W., 89.
 Ellison, W. D., 475.
 Ellison, W. M., 165.
 Elm-site, W. P., 458.
 Elsdon, G. D., 312.
 Elsingher, V., 682.
 Elting, E. C., 29, 70, 71, 72.
 Elton, C., 611.
 Elvehjem, C. A., 190, 191, 367, 457, 463, 689, 789, 892.
 Elvove, E., 590.
 Elwell, J. A., 413.
 Ely, J. O., 397.
 Emack, E. F., 186.
 Emerique, L., 791.
 Emerson, A. E., 649.

- Emerson, H., 608.
 Emerson, P., 810.
 Emerson, W. R. P., 290.
 Emmel, M. W., 264, 268,
 269, 471, 472.
 Emmert, E. M., 432.
 Enderlein, G., 450, 649.
 Enfield, R. R., 885.
 Engel'gardt, V., 243.
 Engelhardt, V., 243.
 Engelhardt, V. M., 542.
 Engels, O., 509.
 England, H. N., 811.
 Engle, E. T., 217, 324.
 Engle, W. J., 555.
 Engledow, F. L., 518.
 Enlow, C. R., 425.
 Enquist, F., 712.
 Epple, A., 97.
 Erdman, H. E., 179, 284.
 Erdman, L. W., 32.
 Ernest, L. B., 773.
 Erwin, A. T., 43.
 Esaki, T., 852.
 Esben-Petersen, P., 853.
 Eshbaugh, F. P., 645, 656,
 899.
 Essig, E. O., 751, 752.
 Esskuchen, E., 324.
 Estes, H. R., 555.
 Euler, B. von, 112.
 Euler, H. von, 112, 300.
 Evanoff, M., 560.
 Evans, A. M., 542.
 Evans, A. T., 123.
 Evans, B. P., 852.
 Evans, H. M., 293, 825,
 826, 897.
 Evaul, E. E., 131.
 Evenius, J., 241.
 Evenson, O. L., 808.
 Everse, J. W. R., 503.
 Ewan, J. W., 147.
 Ewing, H. E., 154.
 Ewing, K. P., 655.
 Exner, F. M., 809.
 Ezekiel, M., 89, 278.
 Faber, H., 862.
 Fackler, H. L., 738.
 Faes, H., 155, 156, 238.
 Fahim, G., 276.
 Fahnstock, M. K., 674, 884.
 Fairchild, F. R., 342.
 Fairfield, W. H., 549, 637.
 Falck, R., 538.
 Falconer, J. I., 387, 573,
 677, 678.
 Falcoz, L., 853.
 Fanson, A., 144.
 Fant, G. W., 348.
 Fargo, J. M., 367.
 Farley, H. B., 340, 786.
 Farrell, A. W., 478.
 Farrar, M. D., 353.
 Farrell, F. D., 7, 88.
 Fassig, O. L., 209.
 Faust, E. C., 647.
 Fawcett, H. S., 231.
 Fedorov, E. E., 114.
 Fejérváry, G. J. de, 620.
 Felt, E. P., 242, 649.
 Fensch, H. L., 277.
 Fenton, F. A., 353, 648.
 Ferguson, A. H., 136.
 Fernández García, R., 129.
 Ferneyhough, J. G., 600.
 Ferrero, A., 725.
 Ferrière, C., 359, 861.
 Ferris, E. B., 31, 88, 127.
 Ferris, G. F., 821, 833.
 Fetrow, W. W., 485.
 Fiadeiro, J., 277.
 Field, A., 295.
 Filipjev, I. N., 649.
 Filmer, R. S., 648.
 Filosofov, M. S., 312.
 Fincher, M. G., 260.
 Findlay, W. P. K., 441.
 Fingerling, G., 160.
 Finlay, T. Y., 594.
 Finn, W. G., 178.
 Finnell, H. H., 210, 211, 217,
 412, 633, 812, 829.
 Fischer, E., 517.
 Fischer, G., 673.
 Fischler, F., 800.
 Fischmann, C., 114.
 Fish, B. O., 100.
 Fish, P. A., 260, 876.
 Fisher, E. A., 238.
 Fisher, G., 200.
 Fisher, R. A., 28, 404, 512.
 Fiske, J. G., 528.
 Fitch, C. P., 263, 562, 668.
 Fitch, J. B., 663.
 Flaas, D. L. van der, 450.
 Flachs, 450.
 Flanders, S. E., 241, 647.
 Fleischhauer, G., 162.
 Fleming, C. E., 62, 74.
 Fleming, W. M., 513, 638.
 Flemion, F., 825.
 Fletcher, R. K., 635.
 Fletcher, S. E. B., 519.
 Fletcher, S. W., 200.
 Fletcher, T. B., 454.
 Fleury, A. C., 358.
 Fleutiaux, E., 852.
 Flinn, F. B., 690.
 Flint, F. W., 717.
 Flint, W. P., 247, 330, 352,
 353, 759.
 Flora, S. D., 209, 809.
 Florell, V. H., 124, 220.
 Fluke, C. L., 56.
 Foister, C. E., 611, 612.
 Folsom, D., 223, 632.
 Folsom, J. W., 56.
 Foltz, V. D., 473.
 Fonder, J. F., 220, 413.
 Foote, M., 414.
 Forbes, E. B., 500, 656.
 Forbes, W. M., 793.
 Foreman, F. W., 109, 110.
 Forrest, H. O., 881.
 Forster, G. W., 573.
 Forster, H. C., 424.
 Fortier, P., 549, 637.
 Foster, F., 217.
 Foster, M. E., 422.
 Foster, M. T., 61.
 Foster, R. G., 684.
 Foulds, F. E., 430.
 Fowler, E. D., 117.
 Fowle, P., 133.
 Francis, E., 650.
 Francis, L. D., 493.
 Franck, O., 567.
 Franck, W. J., 136, 834.
 Franco, A. P. S., 277.
 Frandsen, J. H., 493.
 Frank, E. R., 562.
 Franzen, R., 687.
 Franzke, C., 519.
 Frappa, C., 542.
 Fraps, G. S., 213, 252, 551,
 718.
 Fraser, A. C., 215.
 Fraser, F. C., 853.
 Fraser, W. A. C., 558, 559.
 Fraser, W. J., 869.
 Fraser, W. P., 799.
 Frayser, M. E., 289.
 Fred, E. B., 11, 14, 414.
 Freeborn, S. B., 248, 752,
 753.
 Freeman, E. M., 8, 88.
 Freeman, G. F., 605.
 Freeman, O. W., 16.
 Freeman, R. G., jr., 188.
 Freeman, V. A., 162.
 French, C., jr., 246.
 French, G. T., 136.
 French, H. L., 233, 890.
 French, R. W., 311.
 Frey, C. N., 792.
 Friedemann, W. G., 21.
 Friend, R. B., 599.
 Frisch, K. von, 241.
 Frisch, R. A., 789.
 Frise, H. A., 16.
 Frobisher, M., jr., 857.
 Froker, R. K., 579.
 Fröllich, G., 462.
 Fromme, F. D., 47.
 Frost, S. W., 353.
 Frundanesco, A., 277.
 Fruwirth, C., 827.
 Fry, C. L., 580.
 Fry, W. H., 120.
 Fryar, P. J., 607.
 Fryer, J. C. F., 647.
 Fuchs, G., 547.
 Fuhrman, W. U., 179.
 Fujii, O., 452.
 Fülleborn, F., 154.
 Fuller, O. M., 783.

- Fullmove, W. T., 85.
 Fulton, B. B., 358.
 Fulton, H. R., 51.
 Fu'tz, F. M., 143.
 Funchess, M. J., 200, 518.
 Funk, E. M., 67.
 Funkquist, H., 823.
 Furr, J. B., 840.
 Gabriel, H. S., 733.
 Gahn, O. E., 241.
 Gaiger, S. H., 264.
 Gail, F. W., 419.
 Gaines, E. F., 521.
 Gaines, R. C., 56.
 Gaines, W. L., 370.
 Gainey, P. L., 813.
 Galiano, E. F., 355.
 Gallagher, T. F., 624, 824.
 Gallaher, F., 555.
 Gali-Valerio, B., 171.
 Galloway, Z. L., 178.
 Galpin, C. J., 486, 682, 684.
 Gamkrelidze, W., 248.
 Garber, R. J., 35, 534.
 Garcia, J. De P., 277.
 Garcia, R. F., 129.
 Garde, R. V. La., 529.
 Gardiner, R. F., 121.
 Gardner, F. E., 526.
 Gardner, J. S., 225.
 Gardner, K. B., 680.
 Gardner, W., 418.
 Garewal, J. S., 875.
 Garey, L. E., 677.
 Garlick, W. G., 541.
 Garlick, W. P. G., 527.
 Garner, W. W., 404, 721.
 Garnett, W. E., 185.
 Garren, G. M., 37, 629.
 Garrison, E. R., 72.
 Garside, H. V., 490.
 Garthwaite, E. L., 800.
 Gary, D. P., 890.
 Gasca, M. D., 278.
 Gast, P. R., 809.
 Gatenby, J. B., 518.
 Gaterman, W., 277.
 Gates, R. R., 625.
 Gates, W. H., 215, 216, 822.
 Gault, L., 508.
 Gaut, R. C., 857.
 Gay, M. C., 681.
 Geddes, W. F., 708.
 Gee, W., 88, 185, 580, 581, 582.
 Geer, H. L., 48.
 Geib, W. J., 714.
 Geise, F. W., 334, 340, 838.
 Gemeny, A. L., 271.
 Generoso, V., 462.
 Gentner, L. G., 241, 600.
 Gentry, C. C., 283.
 Gerhard, L. K., 278.
 Gerhardt, F., 419.
 Gerlicke, W. F., 830.
 Gerlaugh, P., 499.
 Gerosa, G., 468.
 Gerould, J. H., 648.
 Gersdorff, W. A., 851.
 Gessele, F., 462.
 Gevorkiantz, S. R., 231.
 Geyer, D. N., 681.
 Gibbons, F. P., 347.
 Gibbons, W. H., 641.
 Gibbs, M. A., 840.
 Gibson, A., 355.
 Gibson, A. W., 88.
 Gibson, W. H., 549, 637.
 Giddings, M. L., 294.
 Giddings, N. J., 534, 645.
 Gide, C., 181.
 Giersbach, J., 640.
 Giese, H., 107.
 Gifford, C. G., 555.
 Gifford, W., 29, 70, 71, 72, 767.
 Gilbert, B. E., 416, 620.
 Gilbert, C. W., 781.
 Gildow, E. M., 472.
 Gile, B. M., 679.
 Gile, P. L., 120.
 Gill, T., 843.
 Gillette, J. M., 579.
 Gilliat, F. C., 454, 541.
 Gillig, E. M., 181, 223.
 Gilligan, G. M., 47, 440, 718.
 Gillis, M. C., 337, 524.
 Gilman, H. L., 260, 263.
 Gilmore, J. W., 727.
 Giltner, W., 263.
 Gimmingham, C. T., 244, 532.
 Ginneken, P. J. van, 277.
 Glaser, A., 769.
 Glaser, R. W., 861.
 Glasgow, H., 250.
 Glassmann, B., 113.
 Glasspoole, J., 114, 314.
 Graves, A. H., 77.
 Glenn, D. S., 788.
 Glenn, P. A., 352.
 Glennie, A. E., 287.
 Glidden, B. I., 334.
 Glinka, N. K., 253.
 Glover, A. J., 500.
 Gloyer, W. O., 138.
 Gnelst, K., 800.
 Goar, L. G., 727.
 Godbole, S. R., 423.
 Godfrey, G. H., 445.
 Godwin, C. H., 223.
 Goff, C. C., 247, 400.
 Goldberger, J., 595.
 Goldschmidt, R., 726.
 Goldstein, B. F., 284.
 Gonggrip, I. H., 457.
 Gonzalez, B. M., 620.
 González Ríos, P., 138.
 Goodell, C. J., 60.
 Gooderham, C. B., 456.
 Goodman, J. W., 663.
 Goodspeed, T. H., 215.
 Goodwin, 532.
 Goot, P. van der, 450.
 Gordon, A., 474.
 Gordon, J. S., 862.
 Gordon, M., 215.
 Gordon, W. S., 170.
 Gorham, R. P., 541.
 Górski, M., 119, 121.
 Gortner, R. A., 201, 801.
 Goss, J. F., 779.
 Goss, R. W., 223, 748, 848.
 Goss, W. G., 873.
 Goss, W. L., 135.
 Gossard, A. C., 43.
 Gould, E., 400.
 Gould, G. E., 859.
 Gourley, J. H., 40, 41.
 Gowen, J. W., 271, 511.
 Gradwohl, R. B. H., 667.
 Graftian, F., 486.
 Graham, C. E., 493.
 Graham, E. C., 275.
 Graham, G. L., 566.
 Graham, R., 263, 374, 375, 379, 380.
 Graham, S. A., 251, 648.
 Graham-Smith, G. S., 109, 110.
 Gramlich, H. J., 499.
 Grant, F. M., 770, 782.
 Gratz, L. O., 223, 345.
 Graves, R. R., 823.
 Gray, A. L., 19.
 Gray, D. T., 105, 106, 200, 899.
 Gray, G. F., 735, 749.
 Gray, L. G., 505.
 Gray, R. B., 381.
 Grayzel, H. G., 398.
 Greaves, J. E., 418.
 Greeley, W. B., 46.
 Green, E. L., 400.
 Green, H. H., 863, 864.
 Green, H. N., 294.
 Green, J. J., 255.
 Greenbaum, F. R., 590.
 Greene, L. M., 564.
 Greene, S. W., 127, 144, 170.
 Greenwood, A. W., 30.
 Gregory, P. W., 424.
 Gregory, T. S., 669.
 Greig, R., 180.
 Greil, L., 278.
 Gresson, R. A. R., 548.
 Grettie, D. P., 501.
 Grewe, E., 709.
 Gries, C. G., 388, 578, 579, 889.
 Griffes, F., 124.
 Griffith, P. E., 555.
 Griffith, W. H., 493.
 Griffiths, D., 231.
 Griffiths, E., 675.
 Grim, G. W., 555.
 Grimes, F. G., 52, 240, 351.
 Grimes, J. C., 764.
 Grimes, M. F., 367.

- Grimes, W. E., 572.
 Grimmett, R. E. R., 431, 635.
 Grindley, H. S., 374.
 Grisdale, J. H., 700.
 Griswold, G. H., 861.
 Groissmayr, F., 808.
 Gross, C. R., 787.
 Gross, D. L., 534.
 Gross, E. G., 586.
 Gross, E. R., 571.
 Gross, J., 694.
 Grossman, E. F., 250, 456.
 Groth, A. H., 29.
 Grubbs, N. S., 555.
 Grunder, M. S., 426, 508, 518.
 Gruse, W. A., 570.
 Gryse, J. J. de, 611, 613.
 Gubin, A. F., 650.
 Guérin, C., 169.
 Guilbert, H. R., 458.
 Guise, C. H., 844.
 Guinness, C. I., 115, 209, 610, 809.
 Gunnison, J. B., 597.
 Gurin, S., 113.
 Gussow, H., 799.
 Gustafson, F. G., 837.
 Guthrie, M. K., 682.
 Gutfeld, L., 450.
 Gwatkin, R., 171, 172, 173.
 György, P., 91.

 Haag, J. R., 870.
 Haas, A. R. C., 142.
 Haasis, F. W., 114, 618, 742.
 Haber, E. S., 43, 525.
 Hackleman, J. C., 329.
 Hadwen, S., 514, 647.
 Hagan, W. A., 280.
 Hahn, G. G., 750.
 Haigh, L. D., 721.
 Haines, W. T., 362.
 Håkansson, A., 322.
 Haldane, J. B. S., 214.
 Hale, P. G., 209.
 Haley, D. E., 37, 334.
 Haley, R. M., 181.
 Hall, A. D., 143.
 Hall, C. J. J. Van, 528.
 Hall, D., 404.
 Hall, E. E., 830.
 Hall, H. G., 30, 38, 99.
 Hall, I. C., 261, 667.
 Hall, I. F., 80.
 Hall, J. A., 541.
 Hall, O. J., 885.
 Hall, S. W., 338.
 Hall, W. J., 471, 670, 879.
 Haller, M. H., 484.
 Hallett, H. S., 70.
 Halliburton, W. D., 770, 893.
 Halliday, N., 93.
 Hallman, E. T., 469, 559, 668.
 Halnan, E. T., 700, 868.

 Halpin, J. G., 789.
 Halton, P., 288.
 Hamilton, B., 393.
 Hamilton, C. H., 185.
 Hamilton, C. M., 557, 558.
 Hamilton, T., 700.
 Hamilton, T. S., 362, 363, 365, 367, 369.
 Hamilton, W. J., jr., 151.
 Hamlyn-Harris, R., 454.
 Hammar, H. E., 412.
 Hammond, H. P., 89.
 Hamner, A. L., 53, 152.
 Hand, I. F., 208, 809.
 Handman, M. S., 580.
 Hanley, J. A., 425.
 Hansen, D., 128.
 Hansen, E. N., 100.
 Hansen, J., 800.
 Hansen, N. E., 231.
 Hansen, P. A., 768.
 Hansen, S. H., 203.
 Hanson, F. B., 214, 621.
 Hanson, H. C., 131.
 Hanson, K. B., 351, 471.
 Hansson, N., 160.
 Harcourt, R., 220.
 Hardenburg, E. V., 732.
 Harding, P. L., 139, 615.
 Hardman, G., 18.
 Hare, H. R., 481.
 Hargreaves, E., 542.
 Hargreaves, H., 451.
 Haring, C. M., 534, 770.
 Harkness, D. A. E., 889.
 Harkom, J. F., 672.
 Harlan, H. V., 330.
 Harland, S. C., 513, 520.
 Harley, C. P., 341.
 Harling, E. P. (Mrs.), 135.
 Harman, M. T., 460.
 Harman, S. W., 249, 740.
 Harned, H. H., 506.
 Harned, R. W., 53, 152, 158, 650.
 Harnisch, O., 241.
 Harper, J. D., 681.
 Harrel, C. G., 488, 480.
 Harrigan, P. V., 358.
 Harrington, F. M., 222, 223.
 Harris, B. B., 214.
 Harris, H. C., 718, 728.
 Harris, J. A., 514.
 Harris, J. W., 200.
 Harris, L. J., 196, 197.
 Harris, E. H., 454.
 Harrison, C. M., 629.
 Harrison, D. C., 588.
 Harrison, E., 56.
 Harrison, F., 200.
 Harrison, F. C., 873.
 Harrison, W. H., 407.
 Hart, C. V., 788.
 Hart, E. B., 191, 367, 457, 463, 688, 689, 789, 892.

 Hart, G. H., 900.
 Hart, H., 335, 699.
 Hart, W. J., 341, 387.
 Harter, L. L., 846.
 Hartke, H., 682.
 Hartman, C. G., 726, 827.
 Hartman, H., 44, 526.
 Hartmann, M., 447.
 Hartzler, A. J., 136.
 Harukawa, C., 58, 159, 850.
 Harvey, R. B., 641.
 Haselhoff, E., 501.
 Haseman, L., 54, 247.
 Hashimoto, K., 260.
 Haskins, H. D., 100.
 Hassall, A., 850.
 Hasseltine, H. E., 468.
 Hastings, E. G., 275.
 Hastings, R. C., 181.
 Hastings, S. H., 128.
 Hatakeyama, T., 93.
 Hatch, K. L., 200.
 Hathcock, J. S., 682.
 Hatt, R. T., 240.
 Hatton, R. G., 51.
 Hauck, C. W., 386, 485.
 Hauge, S. M., 90.
 Hausbrand, E., 174.
 Havens, G. C., 892.
 Hawk, P. B., 112.
 Hawker, H. W., 714, 715.
 Hawkes, F. C., 130.
 Hawkins, R. S., 520.
 Hawkins, S., 344.
 Hawkes, E. B., 160.
 Hawley, E., 187, 581.
 Hawley, R. C., 843.
 Hawthorn, H. B., 580.
 Hay, W. D., 136.
 Hayaishi, Y., 800.
 Hayden, C. E., 260, 264.
 Hayes, A. W., 183.
 Hayes, F. M., 900.
 Hayes, J. B., 554.
 Hayes, W. P., 647.
 Hays, C. H., 474, 877.
 Haythorn, S. R., 555.
 Hazelhoff, E. H., 646.
 Headen, W. P., 80.
 Headley, F. B., 72, 575.
 Heald, W. L., 489.
 Hearle, E., 541, 856.
 Heastie, B., 174.
 Hechler, F. G., 81.
 Heck, A. F., 408.
 Hecke, G. H., 157.
 Hectorne, R. L., 263, 379, 380.
 Hedden, W. P., 579.
 Hedges, W. F., 7.
 Hedrick, U. P., 497.
 Hegner, R., 167, 776.
 Hegner, R. W., 538.
 Heikertinger, F., 648, 649.
 Heilbrunn, L. V., 309.
 Heilman, R. H., 572.

- Hein, I., 338.
 Heinicke, A. J., 739.
 Hejninian, L. M., 393, 394.
 Heldt, P. M., 673.
 Heller, V. G., 876, 897.
 Hellmayr, C. E., 850.
 Hellström, H., 112.
 Helm, C. A., 80.
 Helser, M. D., 499.
 Henderson, C. A., 544.
 Henderson, D. W., 669.
 Henderson, J. L., 768.
 Henderson, T. G., 885.
 Hendricks, W. A., 552.
 Hendrickson, A. H., 527, 617, 777.
 Hendrickson, J. M., 260.
 Hendry, G. W., 727.
 Henning, G. F., 182, 183.
 Henning, W. L., 365.
 Henriksen, H. C., 719, 737.
 Henriksen, K. L., 649.
 Henry, A. J., 16, 209, 505, 809.
 Henry, B. S., 262, 770.
 Henry, H. H., 136.
 Henson, H., 245.
 Hepburn, G. A., 546.
 Herelle, F. d', 875.
 Herms, W. B., 649, 751.
 Herrick, E. H., 826.
 Herrick, G. W., 243.
 Herrick, H. T., 808.
 Herrington, A., 143.
 Herrington, B. L., 871.
 Herrington, W. A., 385.
 Herrmann, O. W., 784.
 Hertig, M., 250.
 Hertwig, P., 822.
 Hertzsch, W., 146.
 Hess, A. F., 590, 694.
 Hessler, M. C., 94, 95.
 Hetler, R. A., 390, 391, 492.
 Hetzel, E. D., 7.
 Heuser, G. F., 662, 759.
 Hewison, H. K., 443.
 Hewitt, E. A., 264, 562.
 Hewitt, J. A., 893.
 Heyl, F. W., 591.
 Heys, F. M., 621, 827.
 Heywood, D. E., 27.
 Hibbard, B. H., 884.
 Hibbard, R. F., 617.
 Hicks, G. C., 321.
 Hicks, W. H., 549, 637.
 Hilbert, D., 170.
 Hildén K., 824.
 Hill, A. E., 398.
 Hill, C. C., 249.
 Hill, G. F., 853.
 Hill, G. O., 572.
 Hill, L. W., 584.
 Hill, R. M., 607.
 Hill, R. S., 766.
 Hillman, F. H., 136.
 Hills, G. B., 506.
 Hills, J. L., 4, 8, 88, 399, 782.
 Hilmy, A., 734.
 Hilton, G., 700, 772.
 Hindmarsh, W. L., 558, 559.
 Hinds, W. E., 252, 355, 647, 650, 653.
 Hinkley, J. S., 89.
 Hinman, E. H., 249.
 Hirata, T., 232.
 Hirschboeck, F. J., 262.
 Hirst, S., 853.
 Hirt, R. R., 150.
 Hiscock, I. V., 555.
 Hitchcock, A. E., 438.
 Hitchcock, A. S., 628.
 Hitchcock, E. A., 89.
 Hjorth-Hansen, S., 203.
 Hoagland, D. R., 615.
 Hoagland, R., 391, 876.
 Hobday, F. T. G., 260.
 Hobe, A. M., 888.
 Hobson, A., 276, 283, 697, 884.
 Hobson, L. G., 679.
 Hobson, R. P., 244.
 Hockensmith, R., 17.
 Hockenyos, G. L., 543.
 Hodgson, R. W., 724, 734, 735.
 Hodson, W. E. H., 360.
 Hoeft, G. L., 466.
 Hoelzel, F., 298.
 Hoerner, J. L., 243.
 Hoffer, F. W., 581.
 Hoffman, A. H., 477, 776, 777.
 Hoffman, A. M., 468.
 Hoffman, I. C., 41.
 Hoffman, W. F., 801.
 Hogan, A. G., 9, 61, 64, 67, 461.
 Hoggan, I. A., 854.
 Hoke, G., 54, 152.
 Holbert, J. R., 328, 346.
 Holbrook, J. E. R., 158.
 Holcomb, R., 549.
 Holdaway, C. W., 164.
 Holdaway, F. G., 647.
 Holder, A. E., 186.
 Holland, E. B., 47, 440.
 Holland, E. O., 200.
 Holland, W. J., 647, 640.
 Holler, H. D., 271.
 Hollinger, M., 688.
 Hollingshead, E. L., 723.
 Holloway, T. E., 648.
 Hollowell, E. A., 26.
 Holm, G. E., 709.
 Holman, C. W., 681, 888.
 Holmes, F. S., 135.
 Holmes, J. S., 144.
 Holmes, W. C., 311.
 Holmes Pegler, H. S., 459.
 Holt, H., 424, 726.
 Holtum, A. W., 75.
 Honcamp, F., 800.
 Honeywell, H. E., 313, 396, 397.
 Hood, R., 682.
 Hooker, H. D., 39, 40.
 Hootman, H. D., 229.
 Hooton, D. R., 443.
 Hoover, M. M., 35, 534.
 Hopkins, A. D., 404, 405.
 Hopkins, A. W., 108.
 Hopkins, E. F., 135, 136.
 Hopkins, E. S., 884.
 Hopkins, G. H. E., 852.
 Hopkins, J. A., jr., 83.
 Hopper, T. H., 413.
 Hopper, W. C., 227.
 Horgan, E. S., 263.
 Horlacher, L. J., 499.
 Horn, C. L., 227.
 Horn, E. E., 446.
 Horn, W., 241, 646, 648.
 Hornby, A. J. W., 611.
 Horsfield, H. T., 537.
 House, F. N., 581.
 Houser, J. S., 540.
 Howard, A., 701, 702, 796.
 Howard, C. H., 462.
 Howard, G. L. C., 701, 796.
 Howard, L. O., 241, 861.
 Howard, W. L., 697.
 Howarth, J. A., 771, 877.
 Howatt, J. L., 223.
 Howe, C. B., 285.
 Howe, F. B., 82.
 Howe, G. H., 738.
 Howell, A. H., 646.
 Howell, L. D., 280.
 Howitt, J. E., 220.
 Howlett, F. S., 41.
 Hoyle, E., 93.
 Hoyle, J. C., 196.
 Hozawa, S., 456.
 Huang, T. F., 250.
 Hubbard, S. C., 639.
 Huber, F. L., 168.
 Huber, L. L., 856.
 Huberty, M. R., 777.
 Hucker, A. M., 373, 392.
 Hucker, G. J., 373, 392.
 Huddleson, I. F., 75, 471, 559.
 Hudelson, R. R., 385.
 Hudson, C. B., 377.
 Hudson, M. G., 559.
 Huelsen, W. A., 337.
 Huerta, A. de la, 852.
 Huffington, J. M., 228.
 Huffman, C. F., 458, 554, 790, 870.
 Hughes, H. D., 33.
 Hughes, J. S., 391.
 Hughes, T. P., 670.
 Hughes, W., 325.
 Hull, F. E., 268, 471, 878.
 Hull, F. M., 655, 656.
 Hull, T. G., 668.

- Hüllhen, W., 200.
 Hülseberg, 449.
 Hultz, F. S., 499.
 Hulvey, C. N., 792.
 Hume, A. N., 519.
 Hume, E. M., 206.
 Hummel, B. L., 684.
 Humphreys, F. B., 260.
 Humphreys, W. J., 16, 809.
 Humphries, A. E., 130.
 Hunger, F. W. T., 231.
 Hungerford, H. B., 56.
 Hunt, G. E., 365, 366.
 Hunt, H. R., 215.
 Hunt, J. K., 570.
 Hunter, B., 282.
 Hunter, H. C., 809.
 Hunter, W. T., 549, 638.
 Hurd, W. E., 16.
 Hurd-Karrer, A. M., 24, 617.
 Hurst, R. R., 223.
 Hurst, W. M., 132, 176, 383.
 Huskins, C. L., 511.
 Husmann, G. C., 435.
 Hutcheson, W. L., 682.
 Hutchins, A. E., 223.
 Hutchinson, R., 130.
 Hutchison, C. B., 300.
 Hutchison, W. J., 209.
 Hutson, J. B., 178.
 Hutson, R., 159.
 Hutt, F. B., 624.
 Hutton, M. K., 394, 895.
 Hutton, S. B., 756, 853.
 Hyde, A. M., 4, 5, 681.
 Hyde, E. C., 693.
 Hynninen, E., 277.
 Ibsen, H. L., 217.
 Iddings, E. J., 200.
 Il'inski, A., 243.
 Iljinskij, A., 243.
 Imhof, O. E., 649.
 Immer, F. R., 236, 623.
 Imms, A. D., 545, 646, 850.
 Inge, C., 784.
 Ingham, L. W., 870.
 Ingram, A., 57.
 Inman, M. T., jr., 151.
 Inomata, S., 648.
 Inouye, J. M., 690.
 Insko, W. M., jr., 368.
 Iorga, N., 276.
 Irish, J. H., 786.
 Irons, F., 78.
 Irwin, J. O., 611, 613.
 Irwin, M. R., 514.
 Irwin, R. E., 555, 556.
 Isaachsen, H., 802.
 Isaacs, B., 398.
 Isely, D., 851.
 Ishii, T., 861.
 Itano, A., 11, 118.
 Ivanova, O. A., 823.
 Jablonowski, J., 648.
 Jack, H. W., 142, 620.
 Jack, R. W., 243.
 Jackson, C. M., 490.
 Jackson, F. H., 882.
 Jackson, H. G., 853.
 Jackson, H. S., 47.
 Jackson, M., 136.
 Jackson, R. W., 790.
 Jacob, H. E., 238, 735.
 Jacob, S. M., 611.
 Jacobsen, A. P., 276.
 Jacobson, H. G. M., 620, 832.
 Jacotot, H., 469.
 Jakowenko, W. A., 290.
 Jakubski, A. W., 241.
 Jamieson, G. S., 109.
 Janda, H. F., 475.
 Jankowska, S. De, 278.
 Jansen, B. C. P., 607.
 Janssen, G., 423, 522, 817, 819, 828, 844, 845.
 Jantzou, H., 800.
 Jardine, J. T., 105.
 Jardine, W. M., 88.
 Jarvis, C. S., 409.
 Jarvis, E., 546, 646.
 Jarvis, F. N., 447.
 Javillier, M., 791.
 Jay, R., 753.
 Jeannel, R., 640.
 Jefferies, J. H., 325, 334.
 Jeffries, C. D., 338, 433.
 Jehle, R. A., 830.
 Jenkins, E. H., 795.
 Jenkins, G. B., 324.
 Jenkins, J. R. W., 58.
 Jenkins, M. T., 420.
 Jenkins, R. G. C., 114.
 Jenness, L. C., 271.
 Jennings, R. D., 179.
 Jenny, H., 17.
 Jensen, H., 223.
 Jensen, O. F., 272.
 Jephcott, H., 296.
 Jepson, F. P., 853.
 Jewett, H. H., 355.
 Joachim, A. W. R., 815, 816.
 Jodidi, S. L., 802.
 Joel, A. H., 136.
 Joffe, J. S., 410.
 Johann, H., 644.
 Johansson, E., 434.
 Johns, C. K., 165.
 Johnson, A. N., 89.
 Johnson, B. L., 587.
 Johnson, B. W., 186.
 Johnson, C., 97.
 Johnson, C. W., 455.
 Johnson, E. R., 678.
 Johnson, G. E., 151, 539.
 Johnson, H. A., 274.
 Johnson, J., 350, 615.
 Johnson, N. W., 700.
 Johnson, O. R., 82.
 Johnson, R. E., 371.
 Johnson, R. P. A., 641.
 Johnson, S. E., 100.
 Johnson, S. W., 303.
 Johnson, W. T., 267, 473, 774.
 Johnston, H. B., 453.
 Johnston, P. E., 385.
 Johnstone, R. N., 269.
 Jones, B. B., 681.
 Jones, C. H., 252.
 Jones, C. R., 200.
 Jones, D. F., 731.
 Jones, D. H., 220.
 Jones, E. E., 266.
 Jones, E. M., 61.
 Jones, E. R., 275.
 Jones, I. E., 870.
 Jones, J. P., 441.
 Jones, J. S., 870.
 Jones, J. W., 429, 682.
 Jones, L. A., 271.
 Jones, L. G., 720.
 Jones, M. M., 77.
 Jones, R. E., 473, 480.
 Jones, W. S., 112.
 Jong, J. K. de, 451.
 Jordan, C. F., 559.
 Jordan, D., 294, 895.
 Jordan, D. S., 239.
 Jordan, K., 646, 648, 852.
 Jordan, L., 562.
 Jørgensen, C. A., 28.
 Jørgensen, H., 205.
 Jørgenson, L. R., 622.
 Josephson, H. B., 382.
 Joslyn, M. A., 504, 787.
 Jul, M. A., 552.
 Jungherr, E., 261, 300, 900.
 Jurney, R. C., 713, 715.
 Justin, M. M., 200, 487.
 Jutting, T. van B., 539.
 Kaburaki, T., 156.
 Kache, P., 228.
 Kachioni-Val'ter, L. S., 318.
 Kadocsa, G., 241.
 Kehlenberg, L., 190.
 Kahlenberg, O. J., 95.
 Kahlfeld, F., 311.
 Kalgorodoff, A., 313, 505.
 Kakizaki, C., 260.
 Kalkus, J. W., 558, 599.
 Kalshoven, L. G. E., 157.
 Kamenef, A., 313.
 Kameneva, A., 813.
 Kamito, A., 156.
 Kammlade, W. G., 187, 364, 375, 890.
 Kamosita, Y., 800.
 Kampen, van, 539.
 Kandiah, S., 815.
 Kannan, K. K., 647.
 Kapp, H. F., 631.
 Karlsen, A., 417.
 Karrer, A. M. H., 24, 617.
 Karrer, P., 112.
 Karshan, M., 693.

- Kasai, K., 260.
 Kilstner, A., 853, 858.
 Katayama, T., 800.
 Katchioni-Walther, L. S., 318.
 Kaucher, M., 490.
 Kaupp, B. F., 206.
 Kauzal, G., 167.
 Kay, R. R., 664.
 Kazakov, A. V., 799.
 Kearney, W., 876.
 Keating, F. E., 331.
 Keeble, J. B., 862.
 Keeler, C. E., 824.
 Keilholz, F. J., 399.
 Keith, J. I., 372, 373.
 Kelbert, D. G. A., 344.
 Kelk, O. M., 136.
 Keller, F., 417.
 Keller, H., 91.
 Kelley, M. A. R., 883.
 Kelley, V. W., 229, 335, 336, 839.
 Kelley, W. P., 697.
 Kellner, O., 160.
 Kellogg, J. H., 223.
 Kellogg, J. W., 555.
 Kellogg, R., 750.
 Kelly, F. J., 200.
 Kelly, G. L., 324, 325.
 Kelley, J. P., 322.
 Kelly, J. W., 376.
 Kelly, M., 92.
 Kelsall, A., 646.
 Kelty, R. H., 457.
 Kemmerer, A. R., 463, 789.
 Kemmer, N. A., 241, 649.
 Kempster, H. L., 67, 68, 461.
 Kendall, J. C., 200.
 Kendrick, M. S., 83.
 Kennard, D. C., 80, 369, 864, 461.
 Kennedy, C., 113.
 Kennedy, C. H., 649, 650.
 Kennedy, P. B., 300.
 Kennedy, R. P., 739.
 Kennedy, W., 143.
 Kern, C. A., 555.
 Kern, F. D., 47, 440.
 Kern, R., 490.
 Kernkamp, H. C. H., 565, 669.
 Kerns, K., 437.
 Kerr, J. A., 714.
 Kerr, W. J., 7.
 Kessel, J. F., 566.
 Kesler, H., 525.
 Kay, K. M., 589.
 Keyes, D. B., 806.
 Keyserlingk, M. von, 278.
 Khalil, M., 241.
 Khan, A. R., 633.
 Kick, C. H., 461.
 Kidd, F., 840, 841.
 Kildson, E., 611.
 Kiesselbach, T. A., 176, 632, 748.
 Kifer, H. B., 93, 295.
 Kik, M. C., 297.
 Kikkawa, S., 132.
 Kildee, H. H., 499.
 Kilgore, B. W., 691.
 Kimball, H. H., 208.
 Kime, P. H., 629, 732.
 Kind, W., 672.
 Kindl, C. H., 882.
 King, B. M., 30.
 King, C. G., 501, 804, 894.
 King, C. J., 442.
 King, F. G., 490, 808.
 King, F. R., 275.
 King, H., 538.
 King, H. H., 647, 852.
 King, J. S., 180.
 King, K. M., 647.
 King, W. V., 546, 648.
 Kinsman, D. F., 116.
 Kirby, S. J., 629.
 Kirk, L. E., 429, 513.
 Kirkpatrick, E. L., 580, 784.
 Kirkpatrick, R. T., 30.
 Kirsch, W., 800.
 Kisilanko, J. P., 152.
 Kisliuk, M., jr., 157.
 Kislovsky, D. A., 28.
 Kisselew, N. W., 25.
 Kisskalt, K., 667.
 Kitson, H. D., 186.
 Kittredge, J., jr., 45, 231.
 Klages, K. H., 779.
 Klefeld, H., 800.
 Klein, A. J., 6, 88.
 Klein, H. Z., 450.
 Kleine, R., 450, 852.
 Klemmedson, G. S., 283.
 Kligler, I. J., 774.
 Klindera, F., 277.
 Klinedinst, L. M., 175.
 Kloth, 673.
 Knandel, H. C., 368.
 Knapp, H. B., 228, 638.
 Kneeland, H., 104.
 Knight, E. W., 20, 32, 40, 64, 99.
 Knight, H. G., 88, 200.
 Knight, J. J., 682.
 Knight, R. C., 51.
 Knobel, E. W., 413.
 Knott, J. E., 338, 433, 836.
 Knowles, W. F., 678.
 Knowlton, F. L., 77.
 Knowlton, G. F., 155.
 Knowlton, H. E., 228.
 Koch, E. M., 805.
 Koch, F. C., 624, 805.
 Koch, P., 806.
 Kocher, A. E., 116.
 Koehler, B., 328, 346.
 Koehne, M., 291.
 Koestler, G. A., 768, 872.
 Kohman, E. F., 93, 396.
 Kohn, F. J., 868.
 Kolb, J. H., 580, 682, 784.
 Kolnitz, H. von, 893.
 Kolotova, S. S., 820.
 Komárek, J., 241.
 Kommers, J. B., 880.
 Kon, S. K., 587.
 Kondo, S., 859.
 Konno, T., 565.
 Konzo, S., 674.
 Kopf, E. W., 183.
 Köppen, W. von, 277.
 Kosswig, C., 824.
 Kostenko, N., 542.
 Kostytschew, S., 24.
 Kotila, J. E., 223, 489, 847.
 Kotok, E. I., 232.
 Kountz, W. B., 127.
 Kozelka, A. W., 423.
 Kozhanchikov, L., 243.
 Kozhantshikov, L., 243.
 Krallinger, H., 124.
 Kramer, B., 296.
 Kramer, M. M., 396, 397.
 Krantz, F. A., 223.
 Krapivina, V. K., 318, 320.
 Krapivine, V. K., 318, 320.
 Kratz, A. P., 674.
 Kratzert, J., 806.
 Krause, A. C., 586.
 Krauss, W. B., 371, 583.
 Kraybill, H. R., 508, 657, 834.
 Kriegsman, B. J., 380, 381.
 Krishna Ayyer, P. N., 853.
 Krishna, B. H. R., 205.
 Krishna, P. G., 719.
 Kriss, M., 656, 862, 863.
 Kristensen, M., 261.
 Kronacher, C., 213.
 Krotowiczówna, J., 121.
 Krueger, M. E., 461.
 Krueger, W. C., 571.
 Krüger, L., 800.
 Krumwiede, C., 259.
 Krusekopf, H. H., 16, 17.
 Kryger, J. P., 650.
 Kuessner-Gerhard, L., 278.
 Kuhlman, A. F., 369.
 Kuhn, H. A., 649.
 Kulkarni, L. B., 425.
 Kulow, H., 324.
 Kulp, D. H., 580, 890.
 Kumm, H. W., 545.
 Kunde, M. M., 625.
 Kunhikannan, K., 542, 647.
 Kunkel, G. M., 876.
 Kuntz, P. R., 129.
 Kuntz, W. A., 345.
 Kupfer, M., 517.
 Kurotschkin, T. J., 773.
 Kurtz, L. D., 535.
 Kusnezov, E. A., 542.
 Kuwabara, K., 260.

- Kuwiyama, S., 647.
 Kuznetsova, E. A., 542.
 Kyes, P., 564.
 Kynett, L., 809.
 Kyzer, E. D., 507.
 Ladd, C. E., 200, 480.
 LaFollette, J. R., 448, 451.
 La Garde, R. V., 529.
 Lagassee, F. S., 736.
 Lagerberg, T., 538.
 Lagerlöf, N., 166.
 Lahaye, J., 565, 566.
 Laidlaw, P. P., 265.
 Laing, F., 852.
 Lal, M. M., 413.
 Lallemand, V., 852.
 Lamba, K. S., 452.
 Lambert, E. B., 138.
 Lambert, W. V., 322, 423, 512.
 Lamberts, F., 462.
 Lamiman, J. F., 732.
 LaMont, T. E., 781, 783.
 Lampman, C. E., 275.
 Lamson, G. H., jr., 378.
 Landauer, W., 30, 460.
 Lander, P. E., 413.
 Landerholm, E. F., 700.
 Landis, B. Y., 486.
 Landon, W. E., 448, 451.
 Landsteiner, K., 29.
 Lang, B., 277.
 Lang, R., 548.
 Langston, J. M., 53, 152.
 Langstroth, L., 694.
 Lanham, W. B., 85.
 Lanning, J. H., 489.
 Lanphear, M. O., 209.
 Larrabee, E. S., 873.
 Larrimer, W. H., 158, 656.
 Larsen, O. H., 276.
 Larson, G. A., 715.
 Larson, J. M., 571.
 Laskowski, B. R., 800.
 Lathrop, F. W., 890.
 Latimer, W. J., 209.
 Latshaw, W. L., 813.
 Laur, E., 276, 582.
 Lawrence, E., 887.
 Lawrence, R. D., 488, 496.
 Lawson, P. B., 457.
 Laycock, T., 149.
 Leaton, L. L., 100.
 Leavitt, H. W., 271.
 Lebediantsev, A. N., 799.
 LeClerc, E. L., 52.
 LeCompte, E. L., 462.
 Lecoq, R., 198, 493, 588, 792, 898.
 Lee, A. L., 280.
 Lee, A. R., 552, 678.
 Lee, E. A., 186.
 Lee, M. O., 151.
 Lee, O. C., 37.
 Lee, W. D., 117, 715.
 Lee, W. W., 876.
 Leendertz, K., 136.
 Leeuwen, E. R. Van, 656.
 Lefevre, J., 598.
 LeFevre, P. E., 782.
 Legg, J., 167, 263.
 Leggatt, C. W., 133, 136.
 Legge, A., 681, 884.
 Lehman, S. G., 348, 443.
 Lehmann, E. W., 381, 382.
 Lehmann, K. B., 770.
 Leiby, R. W., 650.
 Leighton, G., 893.
 Leitz, E. W., 309.
 Leland, E. W., 628.
 Leland, O. M., 200.
 LeMoal, 206.
 Lemon, H. B., 805.
 Lengerken, H. v., 450.
 Leonard, E. O., 836.
 Leonard, L. T., 321.
 Leonard, M. D., 600.
 Leonard, R. J., 136.
 Leonian, L. H., 48, 645.
 Lépiney, J. de, 451.
 Lepkovsky, S., 293, 897.
 LePrince, J. A., 274.
 Lerche, 671.
 Leroy, A. M., 277.
 Lesh, F. B., 716.
 Lesley, J. W., 513, 724.
 Lesley, M. M., 724.
 Leslie, W. R., 524, 549.
 Lesné, E., 592.
 Le Souef, A. S., 167.
 Lestage, J. A., 853.
 Leukel, R. W., 349.
 Leukel, W. A., 326.
 Leulier, A., 594.
 Levaditi, C., 898.
 Leveck, H. H., 162.
 Levick, G. T., 545.
 Levin, W., 596.
 Levine, S. Z., 92.
 Levine, V. E., 583.
 Levitskii, A. P., 799.
 Lewis, E. P., 337.
 Lewis, H. B., 693.
 Lewis, H. G., 116.
 Lewis, I. P., 41.
 Lewis, J. M., 590.
 Lewis, M. T., 339.
 Lewis, P. A., 773.
 Lewis, W. H., 424.
 Lewis, W. J., 555.
 Li, C. P., 170, 773.
 Libbert, M. S., 869.
 Lieber, 422.
 Light, R. F., 792.
 Light, S. S., 55.
 Lightner, D. C., 553.
 Ligon, L. L., 124.
 Lillie, F. E., 511.
 Lima, A. Da Costa, 249.
 Lincoln, F. C., 240, 447.
 Lincoln, M. D., 682.
 Lindequist, de, 486, 487.
 Linder, G. C., 789.
 Lindfors, T., 144.
 Lindow, C. W., 190, 689.
 Lindsey, J. B., 257, 663.
 Line, W. R., 891.
 Linfield, F. B., 200, 290.
 Link, A. DeS., 235.
 Link, G. K. K., 235.
 Link, K. P., 237.
 Linsley, C. M., 212.
 Lipp, J. W., 241, 653.
 Lisse, M. W., 311, 320.
 List, G. M., 55.
 Little, D. M., 209.
 Little, R. B., 687.
 Lively, C. E., 580, 684.
 Livesay, E. A., 622, 658.
 Livingston, B. E., 114.
 Livingstone, C. J., 570, 571.
 Lloyd, J. W., 336, 337.
 Lloyd, O. G., 679.
 Lobdell, B. N., 54, 152, 400.
 Lockhead, A. G., 165, 650.
 Locklin, H. D., 59, 523.
 Loeb, L., 127.
 Loehwing, W. F., 618.
 Lohner, J., 809.
 Lombard, E. F., 462.
 Lombard, P. M., 26, 222.
 Long, H. D., 136.
 Long, J. D., 80.
 Long, L. E., 575.
 Longley, A. E., 421.
 Loomis, H. F., 442.
 López Domínguez, F. A., 32, 42, 99.
 Lorando, N. T., 246.
 Lord, E. M., 822.
 Loree, R. E., 435.
 Lory, C. A., 89.
 Lothe, 263.
 Love, H. H., 521.
 Lovell, O. H., 752.
 Lovell, W. G., 882.
 Lowman, O. E., 871.
 Lowndes, J., 294.
 Lowry, E. J., 881.
 Lowry, O. M., 682.
 Lucet, A., 267.
 Ludwiger, H. von, 277.
 Lund, H., 187.
 Lund, L., 166.
 Lundberg, G., 538.
 Lundberg, G. A., 184, 890.
 Lundblad, O., 355, 854.
 Lundquist, G. A., 891.
 Lundy, G., 779.
 Lunt, H. A., 411.
 Lush, J. L., 900.
 Lutman, A. S., 733.
 Lutman, B. F., 319, 349.
 Lyle, C., 655.
 Lyon, T. L., 810.

- Mabee, W. B., 856.
 McAdie, A., 16.
 McAlpine, J. G., 376, 773.
 McAmis, A. J., 291.
 Macaskill, E. H., 864.
 McAtee, W. L., 447, 539, 547, 646.
 McAuliffe, J. P., 809.
 McBride, C. G., 579.
 McBride, O. C., 647.
 McCallum, A. W., 538.
 McCampbell, C. W., 500.
 McCampbell, S. C., 154.
 McCance, R. A., 488, 496.
 M'Candlish, A. C., 664.
 McCarrison, R., 787.
 McCay, C. M., 688.
 Nachlis, J. A., 714.
 Mack, P. B., 793, 794.
 McClary, J. A., 549, 637.
 McClelland, C. K., 828.
 McClelland, T. B., 731, 737.
 McClendon, J. F., 807, 808.
 McClintock, J. A., 522.
 McClure, F. J., 362.
 McColloch, J. W., 647.
 McCollum, E. V., 686.
 McComas, E. W., 180.
 McCool, M. M., 20.
 McCormick, T. C., 487.
 McCue, C. A., 8, 88, 735, 795.
 McCulloch, E. C., 375.
 McCulloch, L., 320.
 McCullough, A. D., 372, 373.
 McCullough, H. E., 198.
 MacDaniels, L. H., 525, 739, 840.
 McDonald, J. A., 808.
 MacDonald, M. B., 769.
 McDonald, R. E., 648.
 McDonnell, H. B., 100.
 McDonough, T. F., 286.
 MacDougall, E. S., 242.
 McDowall, B. J. S., 770.
 MacDowell, C. G., 126, 216.
 MacDowell, E. C., 125, 126, 216.
 McDowell, J. C., 257.
 McEachran, J. F., 167.
 McEwen, A. D., 773.
 McFayden, J., 874, 875.
 McFarland, J. H., 438.
 MacGibbon, D. A., 280.
 MacGill, E. I., 155.
 McGilliard, P. C., 463.
 McGovran, E. E., 851.
 McGrath, T. T., 558.
 McGregor, E. A., 451.
 MacGregor, M. E., 157.
 McGrew, P. C., 581.
 McGuire, L. P., 139.
 Macha, V., 278.
 Macht, D. I., 125.
 MacIntire, W. H., 818.
 McIntosh, A., 563.
 McIntyre, A. C., 342.
 MacIsaac, F. M., 131.
 McKay, A. C., 563.
 McKay, J. G., 572.
 McKee, C., 330.
 McKenzie, F. F., 499, 761.
 MacKenzie, J. T., 880.
 McKenzie, M. R., 296.
 McKerral, A., 772.
 McKibben, E. G., 272, 471.
 Mackie, D. E., 358, 448, 449.
 Mackie, W. W., 727, 728.
 McKinley, E. B., 169, 467.
 McKinney, H. H., 348.
 McKinney, R. S., 109.
 Mackintosh, M. O., 100.
 McLaughlin, L., 791.
 McLean, F. T., 620.
 MacLean, I. S., 206.
 McLean, R. R., 358.
 MacLeod, D. J., 223.
 MacLeod, G., 192.
 MacLeod, G. F., 450.
 MacLeod, H. S., 223.
 MacLeod, J. J. R., 595.
 MacMillan, A. A., 867.
 McMillan, E., 541.
 MacMillan, H. C., 455.
 McMunn, R. L., 335, 336.
 McMurtrey, J. E., jr., 721.
 McNair, J. B., 9.
 McNamara, H. C., 443.
 McNeal, W. B., 89, 891.
 McNutt, S. H., 267.
 MacPhail, A. J., 276.
 MacPherran, R. S., 880.
 McVey, F. L., 7, 88.
 McWhorter, F. P., 646, 849.
 Macy, H., 463, 464.
 Maddox, F., 146.
 Maddux, W. P., 325.
 Madon, P., 240.
 Madsen, R. La C., 278.
 Madson, B. A., 727.
 Magee, C., 491.
 Magness, J. R., 230, 536, 787.
 Magnusson, H., 76.
 Magrou, J., 146, 148.
 Magrou, M., 148.
 Magruder, R., 42.
 Mahbub Alam, 622.
 Mains, E. B., 47, 236.
 Major, T. G., 799.
 Makarian, M. I., 542.
 Makarjan, M. I., 542.
 Maksimow, A., 119.
 Malan, A. I., 864.
 Maltby, E. V., 682.
 Maltby, R. D., 682.
 Maney, T. J., 139, 228, 434, 615.
 Manley, F. H., 264.
 Mann, A. R., 6, 200, 796.
 Mann, C. E. T., 639.
 Mann, C. W., 528.
 Mann, H. B., 615.
 Manniche, P., 187.
 Manning, J. R., 693.
 Manna, T. F., 719, 745.
 Manny, F. A., 290.
 Manny, T. B., 285, 682.
 Manson, M., 505.
 Mansuy, M. C., 54.
 Manville, I. A., 592.
 Masevitch, S., 241, 543, 758.
 Marcus, B. A., 450.
 Margolf, P. H., 368.
 Markey, J. F., 890.
 Marlatt, A., 95.
 Marlatt, A. L., 89, 200, 588.
 Marlatt, C. L., 88, 157.
 Marley, S. P., 571.
 Marquardt, J. C., 769.
 Marques, L. A. de Azevedo, 155.
 Marsais, P., 849.
 Marschall, F., 487.
 Marsden, E., 700.
 Marsden, S. J., 100.
 Marsh, C. D., 74, 75.
 Marsh, F. W., 321.
 Marsh, R. S., 229, 336.
 Marsh, R. W., 444.
 Marshall, R. E., 229.
 Marsh-Smith, E. C., 842.
 Marston, A., 3, 89.
 Marston, A. R., 541.
 Marten, E. A., 11.
 Martin, E., 866.
 Martin, E. A., 588.
 Martin, E. C., 571.
 Martin, F., 212.
 Martin, F. J., 611.
 Martin, J. H. (Ky.), 68, 125, 368, 624.
 Martin, J. H. (U. S. D. A.), 132, 217, 831.
 Martin, W. H. (Kans.), 166, 465.
 Martin, W. H. (N. J.), 223, 848.
 Martini, E., 449, 648.
 Martini, M. L., 330.
 Martynov, A. B., 649.
 Martynov, S. M., 522.
 Marvin, C. F., 809.
 Marvin, T. O., 482, 575, 576, 888.
 Mason, J. H., 170.
 Mason, K. E., 194.
 Mason, M. F., 790.
 Massee, A. M., 51, 252, 360.
 Massengale, O. N., 551.
 Mast, C. C., 681.
 Masui, K., 514, 620.
 Math, F. A., 809.
 Mather, T. H., 549.
 Matheson, R., 249, 857.
 Mathews, F. P., 900.
 Mathews, G. M., 447.

- Mathews, J. A., 882.
 Matsuba, S., 423.
 Matter, G. E., 555.
 Matters, R. F., 290.
 Matthews, C. A., 462.
 Matthews, G. D., 549, 637.
 Matthews, M. L., 200.
 Mattick, A. T. R., 700.
 Mattick, E. C. V., 700.
 Mattson, S., 410.
 Maugé, L., 212.
 Maughan, W., 843.
 Mauk, C., 727.
 Maume, L., 821.
 Maurer, S., 897.
 Maxton, J. P., 885.
 May, C., 41.
 May, D. W., 601, 731, 737, 751, 768, 796.
 Maynard, E. J., 253, 254, 459.
 Maynard, J. G., 140.
 Maynard, L. A., 131.
 Mead, S. W., 371.
 Meade, DeV., 870.
 Mease, J. A., Jr., 561.
 Megee, C. R., 426.
 Mehring, A. L., 883.
 Meier, K., 525.
 Meier, N. F., 859.
 Meillon, B. De, 57.
 Meinecke, E. P., 743.
 Meissner, F. von, 160.
 Melander, A. L., 649.
 Melburn, M. C., 511.
 Meleney, F. L., 260.
 Melin, E., 538.
 Mellanby, E., 294, 588.
 Mellon, A. W., 283.
 Mellor, J. E. M., 251.
 Melton, L., 682.
 Melvin, B. L., 184, 580, 683.
 Mendel, L. B., 291, 789, 894.
 Mendiola, N. B., 620.
 Mendoza, E. A., 529.
 Menville, L. J., 298.
 Merchant, C. H., 677.
 Mercier, P., 277.
 Mercier, W. B., 200.
 Merrill, E. D., 88, 200, 300, 795.
 Merrill, L. H., 600.
 Messer, M., 885.
 Metz, C. W., 512.
 Metzger, F. J., 448.
 Metzger, W. H., 810, 811, 814, 828, 844.
 Meulen, P. A. van der, 656.
 Meurs, A., 146.
 Meyer, C. R., 390, 391, 492.
 Meyer, E., 144.
 Meyer, H., 673.
 Meyer, K. F., 597.
 Meyer, N. T., 859.
 Meyer, W. H., 531.
 Meyrick, E., 852.
 Michael, L. G., 283, 889.
 Michael, S. T., 471.
 Miche, F., 514.
 Mickel, C. E., 241.
 Middleton, A. D., 240.
 Middleton, R. M., 85.
 Middleton, W., 648.
 Miehler, W., 806.
 Miers, H. A., 451.
 Milbrath, D. G., 145, 148, 149.
 Miles, G. F., 848.
 Miles, L. E., 632.
 Milks, H. J., 260.
 Mill, H. R., 314.
 Miller, A. E., 154.
 Miller, C. D., 457, 489.
 Miller, D., 247.
 Miller, E. K., 409.
 Miller, E. V., 617.
 Miller, G., 792.
 Miller, J. C., 25.
 Miller, J. M., 650.
 Miller, L., 297, 695.
 Miller, M. F., 16, 17, 22.
 Miller, M. R., 62, 74.
 Miller, M. W., 766.
 Miller, N. C. B., 853.
 Miller, P. W., 350.
 Miller, R. F., 459.
 Miller, S. C., 136.
 Miller, T. A. H., 81.
 Mills, W. D., 740.
 Milward, J. G., 848.
 Minett, F. C., 264, 668.
 Minneman, P. G., 573.
 Minot, H. D., 850.
 Mirri, A., 468.
 Mirvish, L., 594.
 Miscall, J., 556.
 Misner, E. G., 130, 178.
 Misra, C. S., 452, 542.
 Mitchell, C. A., 377.
 Mitchell, C. L., 505.
 Mitchell, G. F., 295.
 Mitchell, H. B., 555.
 Mitchell, H. H., 362, 363, 365, 367, 369, 391, 553.
 Mitchell, H. S., 297, 587, 695.
 Mitchell, J. A., 15.
 Mitchener, A. V., 541.
 Mitrovics, J., 486.
 Moen, G., 489.
 Moench, G. L., 424, 726.
 Moffett, H. C., 60.
 Mohler, J. R., 254, 263, 377, 773.
 Moise, T. S., 493.
 Mokand Lal, M., 413.
 Molisch, H., 509.
 Moll, 565.
 Møllgaard, H., 800.
 Monroe, C. F., 108.
 Monroe, J. P., 186.
 Monroy, J. A. v., 343.
 Montague, E. J., 498, 499.
 Montemayor, Z., 478.
 Montgomery, L. M., 686.
 Montgomery, R. H., 285.
 Moodie, W. S., 833.
 Mooers, C. A., 508.
 Moore, C. B., 891.
 Moore, C. C. de Pré, 812.
 Moore, C. R., 624, 824.
 Moore, F. E., 275.
 Moore, H. R., 483, 886.
 Moore, H. W. B., 249.
 Moore, J. S., 6v, 164.
 Moore, L. A., 554.
 Moore, M. G., 798.
 Moore, P., 275.
 Moore, T., 196, 208, 492, 587.
 Moorhouse, L. A., 88.
 Morales Otero, P., 668.
 Moran, T., 161.
 Morcos, Z., 566.
 Moreau, F., 147.
 Moreau, A. F., 93, 295.
 Morgan, B. G. E., 589.
 Morgan, C. S., 280.
 Morgan, E. L., 86.
 Morgan, M. F., 833.
 Morgan, W. L., 860.
 Moriarity, M., 393.
 Morison, F. L., 677.
 Morland, D. M. T., 59.
 Morley, S. L., 682.
 Morrey, C. B., 259.
 Morris, G. C., 554.
 Morris, H. E., 223, 535.
 Morris, H. P., 362, 553.
 Morris, O. M., 340.
 Morris, V. H., 136.
 Morris, W. W., 532.
 Morse, W. J., 226, 733.
 Mortensen, E., 900.
 Morton, R. A., 112, 208.
 Moseley, E. L., 351.
 Mosely, M. E., 553.
 Moser, C. O., 681.
 Moses, B. D., 382, 384, 751, 777.
 Mosher, M. L., 385.
 Moss, E. G., 721.
 Mostyn, R. M., 136.
 Moszczenki, E., 276.
 Mote, D. C., 455.
 Motherwell, W. R., 772.
 Moulton, C. R., 107, 499.
 Moulton, H. G., 280.
 Mouriquand, G., 594.
 Moutia, A., 358.
 Mrak, E. M., 439, 786.
 Muckenfuss, R. S., 774.
 Mueller, W. S., 465.
 Muir, F., 649, 852.
 Mulford, F. L., 144.
 Muller, H., 188, 189.

- Muller, H. J., 124, 214, 621.
 Mullin, F., 7.
 Mumford, C. W., 765.
 Mumford, F. B., 8, 88, 99, 103, 699.
 Mumford, H. W., 200.
 Mumm, W. J., 328.
 Munch, J. C., 446.
 Munn, M. T., 135, 136.
 Munns, E. N., 647.
 Munro, J. A., 159.
 Munro, W. A., 549, 637.
 Munsell, H. E., 93, 295.
 Murlin, J. R., 891, 892.
 Murneek, A. E., 39.
 Murphy, D. F., 115, 209, 610, 849.
 Murphy, H. F., 211.
 Murray, C., 471, 878.
 Murray, R. K. S., 239.
 Murwin, H. F., 833.
 Muse, M., 298.
 Mussehl, F. E., 766.
 Muttkowski, R. A., 853.
 Myers, C. E., 339.
 Myers, H. E., 329.
 Myers, J. G., 360, 545, 852, 860.
 Myers, P. B., 718.
 Myers, V. C., 605.
 Nabours, B. K., 124, 321, 422.
 Nachtsheim, H., 623, 822.
 Nadler, C. S., 79.
 Nafe, R. W., 580.
 Nagai, K., 436.
 Naifo, K., 260.
 Nakamura, J., 260.
 Nakanishi, S., 167, 260.
 Narain, R., 413.
 Narayana, N., 204.
 Nasta, A., 276.
 Nattrass, R. M., 444, 533, 536, 537.
 Natvig, L. E., 241, 242.
 Navashin, M., 723.
 Nayar, C. K., 238.
 Neal, D. C., 145, 644.
 Nedeljković, M., 181.
 Neethling, J. C., 481.
 Negi, P. S., 854.
 Negruzzi, E., 276.
 Neil, B., 598.
 Neiswander, C. R., 856.
 Neiswander, B. B., 248.
 Neller, J. R., 37.
 Nelson, L., 580.
 Nelson, M., 33, 816, 828.
 Nelson, M. V., 595.
 Nelson, O. M., 575.
 Nelson, P., 784.
 Nelson, W. O., 324.
 Nesom, G. H., 831.
 Neuhaus, K. A., 674.
 Neumann, R. O., 770.
 Nevens, W. B., 369.
 Neville, S. L., 136.
 Nevskii, V. P., 242.
 Nevskij, V. P., 242.
 Newcomb, C., 208.
 Newcomer, E. J., 648, 653.
 Newell, H. M., 336.
 Newell, Q. U., 324.
 Newell, W., 399.
 Newhouse, M. J., 576.
 Newlander, J. A., 252, 259.
 Newlon, W. E., 552.
 Newman, H. H., 517.
 Newman, J. E., 175.
 Newman, L. F., 459.
 Newman, L. H., 330.
 Newman, L. J., 158.
 Newsom, I. E., 562.
 Newsom, W. M., 351.
 Newton, G. A., 59, 532.
 Nibler, C. W., 100.
 Nichols, L. H., 209.
 Nichols, M. L., 78.
 Nichols, P. F., 228, 527, 786.
 Nickerson, D., 503.
 Niekirk, J. van, 503.
 Nieschulz, O., 167, 168, 454, 467.
 Nightingale, G. T., 429.
 Nikanorov, S. M., 378.
 Nikitin, V. P., 235.
 Nikolsky, V. V., 647.
 Nissley, W. B., 228.
 Nitsche, M., 515.
 Nixon, E. L., 347.
 Nolan, M. O., 850.
 Nolan, R. E., 345.
 Nolan, W. J., 159.
 Nolf, L. O., 467.
 Noll, C. F., 318.
 Nolla, J. A. B., 246.
 Nord, F. F., 309.
 Nordby, J. E., 29, 623.
 Norgren, L., 887.
 Norris, E. B., 200.
 Norris, E. R., 111.
 Norris, J. H., 667.
 Norris, L. C., 662, 739.
 Norris, R. K., 44.
 Norton, E. A., 716, 811.
 Norton, L. J., 386.
 Norton, R. A., 475.
 Nourse, E. G., 280.
 Oakdale, U. O., 603.
 Obermayer, E., 139.
 O'Brien, R., 104, 695.
 Ochi, Y., 260.
 Oderkirk, B., 462.
 Ogden, W. B., 350.
 Ogrizek, A., 277.
 Ogura, S., 620.
 O'Kelly, J. F., 22, 31, 127.
 Oldham, J. N., 357.
 Olesen, R., 97, 191.
 Oley, W. W., 223.
 Olivella, A. B., 852.
 Oliver, A. W., 79.
 Olsen, N. A., 89, 681.
 Olson, F. C., 363, 366.
 Olson, O., 37, 134, 334.
 Olson, R. E., 884.
 O'Neal, A. M., 714, 715.
 Ong, E. R. de, 647.
 Oppermann, 565.
 Orchymont, A. d', 650.
 Orr, A. B., 76.
 Orr, J. B., 424, 893.
 Orrben, C. L., 19, 716.
 Orton, C. R., 47, 440, 848.
 Osborn, H., 854.
 Osborn, W. M., 331.
 Osland, H. B., 253.
 Osterberger, B. A., 250.
 Osterberger, C. L., 79, 175.
 Osuna, P., 138.
 Oswald, E. I., 830.
 Otero, P. M., 668.
 Otte, W., 266.
 Otto, G. F., 240.
 Owen, F. V., 38.
 Owen, H. H., 772.
 Owen, O., 432.
 Oxer, D. T., 669.
 Pabst, A. M., 686.
 Pack, C. L., 843.
 Pack, H. J., 799.
 Packard, C. M., 241, 647, 656.
 Paddock, F. B., 456.
 Paden, W. R., 329.
 Page, J. L., 611.
 Pailiot, A., 544.
 Painter, T. S., 123, 214, 621.
 Palkin, S., 310.
 Palmer, A. W., 284.
 Palmer, C. C., 468, 772.
 Palmer, L. B., 681.
 Palmer, L. J., 364.
 Palmer, L. S., 113, 391, 554.
 Palmer, R. C., 638.
 Pandittesekere, D. G., 816.
 Paoloni, C., 609.
 Paparozzi, G., 276.
 Pape, H., 47.
 Parfentjev, I. A., 649.
 Park, J. W., 578.
 Park, O. W., 160.
 Park, R. E., 580.
 Park, W. H., 259.
 Parker, A. J., 312.
 Parker, H. L., 248, 548, 860.
 Parker, J. H., 137, 523.
 Parker, J. R., 300, 647, 755.
 Parker, M. E., 466.
 Parker, M. M., 849.
 Parker, R. R., 264.
 Parker, T., 76.
 Parker, W. H., 180.
 Parks, R. R., 68, 77.
 Parshall, C. J., 260.

- Parsons, C. H., 131.
 Partheniu, C., 273.
 Partridge, N. L., 435.
 Parvis, W. J., 73.
 Passerini, N., 713.
 Patch, E. M., 246.
 Paton, R. B., 343.
 Patt, E. M., 834.
 Pattee, A. F., 687.
 Patten, B. M., 164.
 Patterson, G. D., 570.
 Patterson, J. E., 356.
 Patterson, J. T., 214, 322.
 Patton, C. A., 610.
 Patton, W. S., 5+2.
 Patty, R. L., 99.
 Paul, W. R. C., 456.
 Pauls, J. T., 271.
 Paulson, W. E., 681.
 Payne, L. F., 671.
 Payne, L. P., 472.
 Payne, W. B., 516.
 Peacock, W. M., 26.
 Pearce, E. K., 156.
 Pearse, A. S., 358.
 Pearson, G. A., 530.
 Pearson, J. T., 710.
 Pearson, O. H., 323.
 Pearson, R. A., 7.
 Pease, M. S., 725.
 Peck, M., 276.
 Pederson, C. S., 9, 10.
 Peenan, H. van, 516.
 Pegler, H. S. H., 459.
 Peightal, M. F., 413.
 Peirson, H. B., 153.
 Pellett, F. C., 547.
 Pencharz, R. I., 516.
 Pennington, C. E., 795.
 Penquite, B., 876.
 Pererman, F. I., 503.
 Perkins, R. C. L., 832, 853.
 Perkins, W. R., 799.
 Perley, G. A., 11.
 Permar, D., 215.
 Perret, C., 148.
 Perry, E. J., 554.
 Perry, R. L., 717.
 Pescott, R. T. M., 854.
 Petch, C. E., 541.
 Peter, A. M., 68.
 Peter, K., 130.
 Peterman, F. I., 585, 586.
 Peters, A., 277.
 Peters, J. P., 789.
 Peters, R. A., 589.
 Petersen, C. G. J., 213.
 Petersen, P. E., 853.
 Petersen, W. E., 699.
 Peterson, A., 541.
 Peterson, A. G., 784.
 Peterson, E. C., 695.
 Peterson, G. M., 697.
 Peterson, W. H., 11, 14, 190,
 414, 588, 689.
 Pethybridge, G. H., 532.
 Petri, L., 146.
 Petrik, I., 276.
 Petrunkewitch, A., 246, 518.
 Petty, F. W., 648.
 Pfähler, A., 800.
 Phelps, H. A., 890.
 Philip, C. B., 857.
 Phillips, C. A., 769.
 Phillips, C. B., 728.
 Phillips, E. F., 653.
 Phillips, T. G., 360.
 Phillips, W. J., 757.
 Philp, G. L., 734.
 Phipps, I. F., 724.
 Plaskiewicz, L., 277.
 Pickard, J. N., 462.
 Pictet, A., 725.
 Piedallu, A., 155.
 Pieper, J. J., 328, 330.
 Pierce, H. B., 891.
 Pierce, W. D., 245.
 Pierre, W. H., 520.
 Pilchard, E. I., 800.
 Pinckney, R. M., 226.
 Pincus, G., 512.
 Pingrey, H. B., 281.
 Piper, C. S., 410.
 Piper, H. A., 891.
 Piper, R. B., 51.
 Pitman, G. A., 786.
 Plagge, H. H., 139, 615.
 Plant, M., 390.
 Platenus, H., 288.
 Plath, C. H., 129, 138, 162,
 199.
 Platt, C. S., 68, 69.
 Pliginskii, V. G., 243.
 Pliginskij, V. G., 243.
 Plimmer, R. H. A., 294.
 Po, L. Y., 898.
 Poelma, L. J., 580.
 Pogány, J., 486.
 Pohl, G., 167.
 Poletika, W. P. von, 16, 712.
 Pollacci, G., 122.
 Pollitz, B., 673.
 Pollock, R. C., 499.
 Pollock, U. F., 562.
 Pomeroy, C. S., 436.
 Ponikowski, W., 276.
 Ponomarenko, D. A., 243.
 Pool, W. A., 264.
 Poole, H. H., 611.
 Poore, H. D., 842.
 Pop, M. M., 278.
 Pope, W. T., 231, 529.
 Popov, P. V., 542.
 Popovich, G. C., 277.
 Poppe, K., 169.
 Porter, B. A., 648.
 Posdeew, A., 113.
 Post, K., 529.
 Potter, A. A., 89, 209.
 Potter, E. L., 79, 499.
 Poulton, E. B., 539, 649.
 Pound, R., 580.
 Poutiers, R., 252.
 Powers, L., 100.
 Powers, W. L., 23.
 Pratt, J. P., 324.
 Prell, H., 241.
 Prescott, A. T., 681.
 Prescott, J. A., 410.
 Preston, I., 530.
 Prianishnikov, D. N., 799.
 Price, E. W., 774.
 Price, F. E., 79, 872.
 Price, H. B., 579.
 Price, J. C. C., 31, 38, 137,
 571.
 Price, W. V., 556.
 Prickett, P. S., 73.
 Priestley, J. H., 509.
 Pritchett, I. W., 670.
 Prochaska, F. J., 191.
 Prokeš, A., 270, 278, 487.
 Prokofev, F. N., 522.
 Prokofiev, F. N., 522.
 Prosser, C. A., 186.
 Proud, T., 625.
 Prout, L. B., 852.
 Prouty, C. C., 417.
 Prucha, M. J., 371, 372.
 Pryde, J., 309.
 Pucher, G. W., 833.
 Punnett, R. C., 515, 725.
 Purchase, H. S., 76.
 Putnam, G. W., 162.
 Pütz, 486.
 Puzyrnyi, R. G., 542.
 Puzyrnyj, R. G., 542.
 Pyle, R., 438.
 Quackenbush, A. T. A., 842.
 Quam, G. N., 466.
 Quam, S. N., 466.
 Quayle, E. T., 409.
 Quayle, H. J., 358, 448,
 449, 544, 647.
 Quinlan, J., 865.
 Quinn, E. J., 894.
 Quinn, J. T., 30, 39.
 Quirk, A. J., 347.
 Quisenberry, K. S., 37, 134.
 Raeder, T. M., 223.
 Ragins, I. K., 805.
 Ragsdale, A. C., 70, 72, 787.
 Railliet, A., 267.
 Rajewsky, S. A., 269.
 Raleigh, S. M., 518.
 Ram, K., 226.
 Ramachandra, Y., 455.
 Ramakrishnan, T. S., 238.
 Ramanoff, A. L., 827.
 Rambousek, F. G., 649.
 Ramsay, A. A., 633.
 Ramser, C. E., 269, 475,
 671.
 Randall, R., 559.
 Randoin, L., 198, 493, 588,
 792, 898.

- Rangaswami Ayyangar, C., 536.
 Rankin, J. O., 580.
 Rapking, A. H., 580.
 Rasch, W., 449.
 Rasmussen, F., 555.
 Rasmussen, M. P., 680.
 Rastegaleff, E. F., 469.
 Rather, H. C., 426.
 Ray, C. L., 16.
 Ray, G. S., 286.
 Raymond, W. H., 294.
 Raynauld, R., 429.
 Rea, H. E., 520.
 Read, M. T., 312.
 Reader, V., 94, 569.
 Records, E., 76, 264.
 Reddick, D., 223.
 Redfield, R., 580.
 Redman, T., 197.
 Reed, E., 133.
 Reed, F. H., 637.
 Reed, H. J., 30, 38, 99.
 Reed, H. T., 140, 722, 780.
 Reed, O. E., 870.
 Reed, W. D., 241.
 Reed, W. W., 16, 505, 808, 809.
 Reerink, E. H., 502, 804.
 Rees, R. W., 140.
 Reeves, G. I., 158.
 Regnier, R., 647.
 Reich, E., 278, 486.
 Reichenow, E., 240.
 Reichle, H. S., 422.
 Reid, D. H., 551.
 Reid, H. A., 770.
 Reid, M. E., 837.
 Reid, W. H. E., 72.
 Reimann, H. A., 773.
 Reimer, F. C., 44.
 Reinhard, H. J., 246, 655.
 Reinking, O. A., 529.
 Remezov, N., 799.
 Remington, R. E., 808, 893.
 Reasovsky, N. W. T., 724.
 Rettger, L. F., 773.
 Rew, H., 480.
 Reynoldson, L. A., 132, 674.
 Rhoads, A. S., 344.
 Rhode, C. S., 386.
 Rhumbler, L., 450.
 Riazantseva, Z. A., 712.
 Ricciardi, N., 186.
 Rice, F. E., 583.
 Rice, J. W., 555.
 Rice, V. A., 498.
 Richards, P., 82.
 Richardson, A. E., 89.
 Richardson Kuntz, P., 129.
 Richert, P. H., 786.
 Richie, H. B., 464.
 Hickey, L. F., 386.
 Ricks, G. L., 600.
 Ricks, J. R., 96, 199.
 Riddell, F. T., 480.
 Riddet, W., 700.
 Riddle, O., 216, 515, 597, 625, 823, 825.
 Rideout, E., 480.
 Riesch, A. F. von V., 450.
 Riffenburg, H. B., 672.
 Rightmire, G. W., 7.
 Rising, B., 898.
 Riley, J. O., 497.
 Rimington, C., 609.
 Rios, P. G., 138.
 Ripley, L. B., 546.
 Ripperton, J. C., 685.
 Ritchie, W. S., 9, 61.
 Ritter, F., 450.
 Ritter, W. E., 539.
 Rittershaus, T., 822.
 Rivera, T., 583.
 Rivera, V., 122.
 Rivers, T. M., 774.
 Rivkin, H., 590, 694.
 Rjasanzewa, S. A., 712.
 Roach, W. A., 532.
 Roadhouse, C. L., 768, 769, 872.
 Roark, R. C., 241, 649, 754.
 Robb, R. C., 216, 822.
 Robbins, B. H., 470.
 Robbins, E. T., 381.
 Robbins, F. S. R., 596.
 Robbins, W. J., 23.
 Robbins, W. R., 429.
 Roberts, E., 376, 822.
 Roberts, E. H., 598.
 Roberts, L. J., 688.
 Roberts, O. S., 834.
 Roberts, R. H., 43.
 Robertson, A., 447.
 Robertson, D. D., 325.
 Robey, L., 875.
 Robinson, C. S., 790.
 Robinson, J. L., 33.
 Robinson, R. H., 245, 438, 524, 539.
 Robinson, T. R., 842.
 Robison, W. L., 65, 66, 660, 763.
 Robschert-Robbins, F. S., 596.
 Robson, W., 893.
 Rochford, L. H., 459.
 Rodeffer, C. C., 581.
 Rodenhiser, H. A., 648.
 Rodgers, R. H., 186.
 Rodillon, J., 164.
 Roe, G. C., 74.
 Roepke, W., 650.
 Roethe, H. E., 82.
 Roger, L., 277.
 Rogers, C. F., 37.
 Rogers, E. C., 94.
 Rogers, H. S., 200.
 Rogers, T. A., 487.
 Rogers, W. B., 830.
 Rohwer, S. A., 859.
 Roifs, P. H., 455.
 Romanoff, A. J., 827.
 Romanoff, A. L., 460.
 Ronzoni, E., 648.
 Romberg, L. D., 143.
 Roosevelt, T., Jr., 850.
 Root, F. M., 167, 647.
 Root, G. A., 150.
 Rooy, N. de, 539.
 Rosa, J. T., 800.
 Roscoe, M. H., 194, 195.
 Rose, F., 200.
 Rose, M., 539.
 Rose, M. S., 90, 585, 686.
 Rose, W. C., 191, 693.
 Rosedale, J. L., 587.
 Rosen, H. R., 444, 549.
 Rosenheim, O., 113, 588, 606.
 Rosenow, E. C., 559.
 Rosewarne, D. D., 687.
 Rosling, E., 824.
 Ross, H. A., 781.
 Ross, I. C., 167, 558, 563.
 Ross, R. C., 386.
 Ross, W. A., 541, 648.
 Rostafinski, J., 277.
 Rostand, J., 321.
 Roth, W. J., 573.
 Rothger, B. E., 132.
 Rowan, W., 850.
 Royster, L. T., 792.
 Rubay, M., 566.
 Rubino, P., 96.
 Ruden, W. L., 479.
 Rudolfs, W., 572, 650.
 Rue, N. B., 681.
 Ruehe, H. A., 372.
 Runnels, H. A., 644.
 Ruprecht, R. W., 317, 325, 334.
 Rusk, H. P., 362, 386.
 Russell, E. J., 862.
 Russell, H. L., 2, 88.
 Russell, W. C., 95, 462.
 Rust, L. O., 487.
 Ruth, W. A., 229, 335, 336.
 Rutzler, J. E., Jr., 801.
 Ruyter de Wildt, J. C. de, 163.
 Ruzaev, K. S., 542.
 Ruzicka, L., 244.
 Ryan, H. J., 358.
 Rydbom, M., 112.
 Rymer, M. R., 261.
 Saalas, U., 649.
 Sabinin, D. A., 820.
 Sacharov, N. L., 542.
 Sachtleben, H., 545.
 Sackett, R. L., 89.
 Saillard, E., 277.
 St. George, R. A., 55, 158.
 St. John, J. L., 340.
 Ste. Marie, J. A., 549, 637.
 Sakamoto, K., 167.
 Sakharov, N. L., 542.
 Salaman, R. N., 130.
 Salminen, A., 119.

- Salmon, E. S., 49, 532, 537.
 Salmon, S. C., 424, 634.
 Salt, G., 358, 854.
 Salter, R. M., 22, 45.
 Salvesen, H. A., 789.
 Sámál, J., 648.
 Samuels, L. T., 16, 809.
 Sanders, J. T., 784.
 Sanders, K. B., 818.
 Sanders, P. D., 157.
 Sanders, S. D., 681.
 Sanderson, D., 580, 682, 684.
 Sandground, J. H., 850.
 Sands, W. N., 142.
 Sandstedt, R. M., 288.
 Sanfilippo, E., 563.
 Santschi, F., 853.
 Saraiva, J., 278.
 Sarel-Whitfield, F. G., 853.
 Sarra, R., 154.
 Sartoris, G. B., 333.
 Sasse, A. R., 710.
 Saunders, A. A., 850.
 Saunders, A. R., 628.
 Saupé, R., 450.
 Savage, W. G., 561.
 Sawyer, C. E., 557, 559.
 Sawyer, W. A., 857.
 Sax, K., 621.
 Saywell, H. G., 787.
 Scanlon, J. C., 285.
 Scaramuzza, L. C., 542.
 Schaad, R. E., 272.
 Schaaf, J., 566.
 Schaal, L. A., 455.
 Schaenzler, J. P., 275, 572.
 Schafer, E. G., 37.
 Schafer, E. R., 830.
 Schaffner, J. H., 624.
 Schaffnit, E., 49, 146, 285.
 Scharrer, K., 800.
 Scheffer, T. C., 640.
 Scheffer, T. H., 52.
 Schenk, G., 647.
 Schermerhorn, L. G., 429.
 Schertz, F. M., 616.
 Scheunert, A., 296, 395, 800.
 Schieblich, M., 94, 296.
 Schilling, S. J., 775.
 Schimtschek, E., 450.
 Schindler, A., 276.
 Schirmer, W., 125.
 Schlenker, F. S., 360.
 Schlesinger, A. M., 580.
 Schmidt, A., 277.
 Schmidt, D., 135.
 Schmidt, E. H., 523.
 Schmidt, H., 665.
 Schneider, W. E., 280.
 Schneiderhan, F. J., 400.
 Schoenfeld, W. A., 223.
 Schoonover, W. R., 448.
 Schoth, H. A., 36.
 Schourawleff, 170.
 Schoute, E., 455.
 Schrader, A. L., 526.
 Schrader, F., 544.
 Schreiber, A., 278.
 Schtibler, M., 277.
 Schuckmann, W. von, 449.
 Schuleen, E. T., 16.
 Schulte, R. B., 834.
 Schultz, E. S., 223.
 Schultz, F. W., 893.
 Schulze, A. F., 378.
 Schulze, R., 712.
 Schumaker, E., 467.
 Schuster, G. L., 131, 718, 728.
 Schuurmans, Stekhoven, J. H., jr., 560.
 Schwalbold, J., 800.
 Schwantes, A. J., 477.
 Schwaradt, H. H., 851.
 Schwartz, B., 563, 670, 774.
 Schwartz, M. E., 555.
 Schwarz, M. B., 47, 50, 236.
 Scooby, F. C., 778.
 Scofield, W. W., 555.
 Scott, C. E., 149.
 Scott, C. L., 298.
 Scott, I. T., 46, 50.
 Scott, J. P., 261.
 Scott, S. G., 100.
 Scoville, G. P., 781, 783.
 Seal, J. L., 845.
 Seamans, H. L., 242, 541.
 Searfoss, R., 188.
 Searls, E. M., 649.
 Sears, F. C., 230.
 Sears, O. H., 316, 329.
 Seaton, R. A., 89, 200.
 Sebenzow, B. M., 450.
 Sebrell, W. H., 695.
 Seckinger, D. L., 125.
 Seddon, H. R., 167, 487, 470, 558, 559.
 Séguy, E., 450.
 Seidel, H., 524.
 Seidell, A., 711.
 Seifried, A., 566.
 Seifn, F., jr., 153.
 Sell, I. I., 488.
 Senner, A. H., 97.
 Serban, M., 277.
 Serbrovsky, A. S., 725.
 Sergeant, Ed., 157.
 Sergeant, Etienne, 157.
 Serrano, L. A., 129, 600.
 Serviss, G. H., 520.
 Severin, H. H., 752.
 Sewell, M. C., 813.
 Seyrig, A., 548.
 Shaeffer, 53.
 Shamel, A. D., 142, 436.
 Shannon, R. C., 856.
 Sharp, E. A., 398.
 Sharpless, G. R., 320.
 Shaw, A. M., 550.
 Shaw, C. F., 717, 812.
 Shaw, C. R., 265.
 Shaw, F. J. F., 226.
 Shaw, F. W., 261.
 Shaw, H. B., 89.
 Shaw, N., 402, 611.
 Shaw, P. A., 260.
 Shaw, W. M., 818.
 Shawl, R. I., 381.
 Shchelkanovtsev, I. A. P., 242, 541.
 Shealy, A. L., 374, 653.
 Shear, E. V., 741.
 Shear, E. V., jr., 400.
 Shear, G. M., 799.
 Shear, M. J., 296.
 Shear, S. W., 578.
 Shedd, C. K., 275.
 Sheets, E. W., 499.
 Shelford, V. E., 809.
 Shen, T. H., 620.
 Shepardson, W. H., 301, 302, 304, 303, 306, 307, 308, 300.
 Shepherd, G. S., 484.
 Shepherd, J. B., 369.
 Shepperd, J. H., 367, 500, 700, 760.
 Sherbakoff, C. D., 645.
 Shere, L., 466.
 Sherman, F., jr., 600.
 Sherman, H. C., 97, 494, 495, 584.
 Sherman, J. M., 556.
 Sherman, L. W., 638.
 Sherman, W. A., 222.
 Sherwood, R. C., 489.
 Shigley, J. F., 370, 555.
 Shimamura, T., 260.
 Shimizu, T., 93.
 Shinn, E. H., 200.
 Shirahama, K., 202.
 Shirky, S. B., 99.
 Shoemaker, J. S., 40, 41, 527, 645.
 Shoffner, C. P., 447.
 Shohl, A. T., 694.
 Shope, R. E., 773, 878.
 Shotwell, R. L., 155.
 Show, S. B., 232, 639.
 Showalter, W. J., 151.
 Shrewsbury, C. L., 67, 461.
 Shriner, B. L., 9.
 Shriver, L. C., 131.
 Shroat, H. E., 555.
 Shull, A. F., 446.
 Shuman, J. W., 16.
 Sideris, C. P., 418, 419, 437.
 Siegler, E. A., 50, 31.
 Sieglinger, J. B., 331, 513.
 Sievers, F. J., 200, 813.
 Silver, J., 446, 447.
 Silvestri, F., 155, 646, 650.
 Simmonds, F. A., 830.
 Simmonds, J. H., 154.
 Simmonds, N., 686.
 Simmonds, P. M., 584.
 Simmons, C. S., 715.

- Simmons, P., 241.
 Simonet, M., 215.
 Simonnet, H., 96.
 Simpson, F., 367.
 Simpson, H. E., 672.
 Simpson, L. J., 541.
 Simpson, M. E., 825, 826.
 Simpson, W. M., 263.
 Sims, N. L., 580.
 Sinclair, W. B., 801.
 Singh, B., 408.
 Singh, C. K., 377.
 Singh, J., 875.
 Singleton, W. R., 731.
 Sinitstn, D. T., 753.
 Sipple, H. L., 804.
 Sjogren, O. W., 300.
 Sjollem, B., 876.
 Skilbeck, D., 885.
 Skinner, F. L., 529.
 Skinner, H. M., 854.
 Skinner, J. H., 200.
 Skinner, W. W., 100.
 Skopintsev, B. A., 799.
 Slate, W. L., 599.
 Sledge, W. A., 838.
 Sletova, M. V., 253.
 Sloep, A. C., 310.
 Slonaker, J. R., 127, 517.
 Small, F. W., 479.
 Small, W., 235, 236, 238.
 Smedley-MacLean, I., 206.
 Smee, C., 55.
 Smick, A. A., 87.
 Smit, B., 358.
 Smith, A., 505, 717.
 Smith, A. D. B., 29.
 Smith, A. H., 493.
 Smith, A. L., 845.
 Smith, C. B., 88, 287.
 Smith, C. N., 135.
 Smith, D. C., 634.
 Smith, E., 182.
 Smith, E. C., 161.
 Smith, E. C. M., 842.
 Smith, E. F., 167.
 Smith, G. H., 875.
 Smith, G. M., 853.
 Smith, G. S. G., 109, 110.
 Smith, H. D., 248, 249.
 Smith, H. G., 892.
 Smith, H. H., 206, 255, 549.
 Smith, H. P., 382.
 Smith, H. S., 57, 647, 757, 851.
 Smith, J. B., 416, 555.
 Smith, J. H., 544.
 Smith, K. E., 136.
 Smith, K. M., 56.
 Smith, L. B., 648.
 Smith, L. H., 118, 716.
 Smith, L. L. W., 93.
 Smith, L. M., 242, 752.
 Smith, L. W., 875.
 Smith, M. E., 494, 896.
 Smith, M. I., 590.
 Smith, M. R., 153.
 Smith, O., 722.
 Smith, P. E., 324.
 Smith, R. C., 698.
 Smith, R. H., 156, 241, 433, 505, 851.
 Smith, R. M., 867.
 Smith, R. S., 118, 716.
 Smith, R. W., 349.
 Smith, S. L., 88, 89, 104, 293.
 Smith, T. O., 360.
 Smith, W. L., 809.
 Smith, Z. M., 186.
 Snapp, O. I., 357, 633, 656.
 Snapp, R. R., 361.
 Snedden, D., 186.
 Snell, G. D., 323.
 Snell, K., 223.
 Snider, G. G., 391.
 Snider, H. J., 315, 316, 328.
 Snyder, L. H., 514.
 Snyder, T. E., 56, 245, 647.
 Snyder, W. A., 553.
 Soares Franco, A. P., 277.
 Sokovnina, N. I., 319.
 Sommer, A. L., 619.
 Somogyi, M., 408.
 Sonderlegger, A., 505.
 Soparkar, M. B., 560.
 Sopolis, M. P., 555.
 Sordelli, A., 261.
 Sorokin, H., 619.
 Sorokin, P. A., 286, 580.
 Sotola, J., 657.
 Souders, M., jr., 882.
 Soule, A. M., 8, 88.
 South, F. W., 239.
 Spackman, L. S., 312.
 Spahr, R. H., 89.
 Spalding, J. L., 712.
 Sparhawk, W. N., 276.
 Spaulding, P., 239.
 Spears, H. D., 360.
 Speer, J. H., 591.
 Spencer, G. J., 541.
 Spencer, H., 241, 252, 650.
 Spencer, J. H., 809.
 Spencer, L., 86.
 Spencer, R. E., 209.
 Spencer, V. E., 314.
 Sperandio, A., 586.
 Sperry, C. C., 446.
 Speyer, W., 56.
 Spinks, G. T., 139.
 Spracher, M. L., 135, 136.
 Sprague, H. B., 130, 131.
 Sprengel, L., 56.
 Spurway, C. H., 12.
 Squirrel, W. J., 220.
 Sreenivasaya, M., 204, 205.
 Stableforth, A. W., 668.
 Stadler, W. C., 607.
 Stadler, L. J., 30, 510.
 Staehelin, M., 123, 238.
 Stafford, H. M., 505.
 Stafseth, H. J., 172, 268.
 Stahl, C. F., 542.
 Stair, R., 479.
 Stakman, E. C., 236.
 Stalfelt, M. G., 24.
 Stallard, R., 862.
 Stammeshaus, L., 57.
 Standfuss, R., 167.
 Staniland, L. N., 448.
 Stanley, L., 104, 287, 289.
 Stanley, W. W., 543.
 Stanton, T. R., 35, 521, 632.
 Stapledon, R. G., 425, 426.
 Stark, C. N., 556.
 Stark, P., 556.
 Starkey, R. L., 415.
 Starr, S. H., 728, 796.
 Starring, C. C., 223.
 Staub, A., 171.
 Staudinger, H., 244.
 Stauffer, W. H., 581.
 Stearns, G., 394.
 Stearns, L. A., 248, 540.
 Steel, G. E., 693.
 Steel, S. L., 585.
 Steenbock, H., 191, 367, 458, 463, 688, 689, 892, 898.
 Steenburgh, W. E., 58, 541.
 Steer, W., 252.
 Steinberg, E. A., 820.
 Steiner, G., 861.
 Steiner, L. F., 247, 248.
 Stekhoven, J. H. S., jr., 560.
 Stellwaag, F., 648.
 Stenhouse, R., 700.
 Stephens, P. H., 784.
 Stephenson, M., 707.
 Stephenson, R. E., 411.
 Sterges, A. J., 614.
 Stern, C., 322, 822.
 Stern, J. K., 86.
 Steudel, H., 396.
 Stevens, F. D., 333.
 Stevens, F. L., 697.
 Stevens, G. A., 438.
 Stevens, K. R., 797, 814.
 Stevens, M., 682.
 Stevens, O. A., 136.
 Stevens, W. R., 16.
 Stevenson, G. L., 68, 85.
 Stevenson, T. M., 220.
 Stevenson, W. H., 19.
 Stevenson, W. L., 555.
 Stewart, C. L., 386, 884.
 Stewart, C. P., 197.
 Stewart, G., 27, 440.
 Stewart, H. A., 282.
 Stewart, J. E., 16.
 Stewart, J. G., 425, 862.
 Stewart, K. E., 242.
 Stewart, P. H., 534.
 Stewart, R., 18, 409.
 Stewart, W. L., 689.
 Steyer, 450.
 Stichel, W., 241.
 Stickel, P. W., 809.

- Stickels, A. E., 125.
 Stiebeling, H. K., 494, 495.
 Stiles, C. W., 355, 649, 850.
 Stine, O. C., 89, 884.
 Stirniman, E. J., 273, 332, 384, 697, 777.
 Stirrett, G. M., 541.
 Stirrup, H. H., 147.
 Stoa, T. E., 330.
 Stober, 450.
 Stockard, C. R., 510.
 Stoeltzner W., 114.
 Stokes, W. E., 325.
 Stoll, N. R., 378.
 Stone, A. H., 682.
 Stone, A. L., 136.
 Storer, T. I., 753.
 Stouder, K. W., 474.
 Stout, A. B., 738.
 Stradling, R. E., 672.
 Strahan, C. M., 78.
 Straight, E. M., 549, 637.
 Straszheim, R. E., 286, 678.
 Street, O. E., 831.
 Streeter, L. B., 740.
 Streiff, A., 504, 505.
 Sresemann, E., 539.
 Strickland, E. H., 541.
 Stringfield, O. L., 594.
 Strobl, L., 276.
 Strong, L. C., 216.
 Stshelkanovtzev, J. P., 242, 541.
 Stuart, H. C., 584.
 Stuart, H. O., 553.
 Stuart, W., 222, 223.
 Stubbs, J. B., 312.
 Sturgess, G. W., 187.
 Sturgis, C. C., 398.
 Sturlaugson, V., 129, 138, 162, 109.
 Subramaniam, L. S., 535.
 Sudds, R. A., 229.
 Sullivan, K. C., 54.
 Sullivan, O. M., 186.
 Sumi, M., 96.
 Sumner, F. B., 821.
 Sundararaman, S., 238.
 Sunderville, E., 260.
 Supplee, G. C., 190.
 Sure, B., 297, 494, 896.
 Surle, E., 538.
 Sussmann, A., 181, 890.
 Sutton, G. L., 889.
 Suzuki, S., 167.
 Svedberg, T., 407, 606.
 Swanback, T. R., 620, 831, 832, 833.
 Swanson, A. F., 331.
 Swanson, C. O., 698.
 Swarbrick, T., 189, 840.
 Swartwout, H. G., 39, 40.
 Swartz, V., 198.
 Sweany, H. C., 560.
 Sweet, A. T., 716.
 Sweetman, H. L., 158, 546.
 Swellengrebel, N. H., 249, 455.
 Swezey, O. H., 542, 648.
 Swingle, C. F., 509.
 Swingle, H. S., 55, 357, 653, 656.
 Swingle, W. T., 421, 436, 620.
 Swope, W. D., 373.
 Symond, J. E., 443.
 Szarka, A., 899.
 Taber, L. J., 88, 682.
 Tadokoro, T., 202.
 Taft, P. C., 89.
 Taggart, J. G., 540, 637.
 Tai, T. Y., 856.
 Takahashi, E., 102.
 Takahashi, I., 436.
 Takahashi, R., 452.
 Takatusukasa, N., 620.
 Talbert, T. J., 30, 39, 40.
 Talbot, M. W., 38.
 Talliaferro, W. H., 235.
 Talmadge, H. R., 223.
 Tanaka, T., 436.
 Tange, M., 825.
 Tanikawa, T., 436.
 Tannenbaum, F., 283.
 Tanner, F. W., 166, 667.
 Tanner, V. M., 455.
 Tanret, G., 96.
 Tapernoux, F. E., 276.
 Tapke, V. F., 48.
 Tapley, W. T., 700.
 Tardy, L., 277.
 Tasci, G., 277.
 Taslim, M., 535.
 Tasugi, H., 800.
 Tatarinova, N. V., 255.
 Tattersfeld, F., 244, 532.
 Tavernetti, J. B., 394, 777.
 Tavernetti, T. F., 697.
 Tayler, A. J. W., 571.
 Taylor, A. E., 181, 484.
 Taylor, C. A., 777.
 Taylor, C. C., 572, 580, 682.
 Taylor, C. R., 635.
 Taylor, H. C., 275, 885.
 Taylor, H. V., 611, 612.
 Taylor, J. K., 811.
 Taylor, R. F., 743.
 Taylor, W., 875.
 Taylor, W. C., 764.
 Teorbadjief, P., 649.
 Teague, C. C., 681, 682, 697.
 Tedder, G. E., 325.
 Tedin, O., 623.
 Telenga, N. A., 542.
 Teller, L. W., 882.
 Templeton, G. S., 63, 64, 68, 161, 163, 550.
 Tennant, J. L., 83, 278.
 Tenney, F. G., 414.
 Teodoresco, I. C., 277.
 Terao, H., 620, 800.
 Terrell, W. G., 360.
 Terzaghi, C., 567.
 Thaker, B. J., 548.
 Thatcher, L. E., 66, 634.
 Theiler, A., 863.
 Theobald, F. V., 57.
 Theodoroff, A., 277.
 Thomas, B., 893.
 Thomas, C. A., 154, 353, 354, 456.
 Thomas, D. S., 286.
 Thomas, E. F., 374.
 Thomas, J. E., 454.
 Thomas, M. T., 426.
 Thomas, W. A., 241.
 Thomas, W. P., 886.
 Thomashoff, E., 168.
 Thompson, C. H., 231.
 Thompson, D. G., 474.
 Thompson, D. O., 682.
 Thompson, E. G., 130.
 Thompson, H. C., 42, 226.
 Thompson, J. B., 227, 256, 299.
 Thompson, J. J., 608.
 Thompson, M. W., 45.
 Thompson, R. J., 487, 885.
 Thompson, R. W., 541.
 Thompson, W. C., 658.
 Thompson, W. R., 151, 241, 448, 548, 851, 860.
 Thomsen, F. L., 482.
 Thomsen, M., 646.
 Thomsen, O., 216.
 Thomson, J. G., 447.
 Thomson, R., 228.
 Thor, C. J., 330.
 Thornburg, H. D., 394.
 Thorne, C. E., 809.
 Thorne, G. B., 482.
 Thorp, F., jr., 375, 379, 380.
 Thorpe, G. K., 167.
 Thorpe, M., 88.
 Thorvaldson, T., 568, 569.
 Throckmorton, R. I., 634.
 Thurlimann, L., 136.
 Thurman, B. H., 398.
 Thurston, H. W., jr., 347, 440.
 Thurston, L. M., 554.
 Tigert, J. J., 7, 200.
 Till, F. D., 812.
 Tillyard, R. J., 646, 648, 853.
 Timmerhans, L., 462.
 Timofeeff-Ressovsky, N. W., 724.
 Timoney, J. F., 876.
 Tinker, M. A. H., 524, 611, 612.
 Tingey, D. C., 147.
 Tinley, J. M., 285, 697.
 Tinline, M. J., 549, 637.
 Tischler, N., 653.
 Tisdale, H. B., 732.
 Tisdale, W. B., 325, 343.

- Tittsler, R. P., 320, 380.
 Titus, H. W., 552.
 Titus, R. W., 391.
 Tobey, E. R., 632.
 Todd, F. E., 858.
 Toenjes, W., 600.
 Toit, P. J. du, 561, 863, 864.
 Tolley, H. R., 89, 300.
 Tolstol, E., 491.
 Tomhave, A. E., 763, 765.
 Tomhave, W. H., 500.
 Topper, A., 188, 189.
 Torrey, J. P., 559.
 Toshijima, Y., 260.
 Toullec, F., 169.
 Toumanoff, K., 251.
 Townend, R. V., 805.
 Townner, A. A., 489.
 Townsend, C. H. T., 536.
 Towt, L. V., 808.
 Toy, L. R., 400.
 Tracy, P. H., 371, 372.
 Trägårdh, L., 649.
 Trask, E. B., 842.
 Traub, H. P., 330.
 Traum, J., 169, 770.
 Traut, I. I., 799.
 Trautwein, K., 168, 668.
 Trehan, K. N., 58.
 Trimble, C. S., 258.
 Tripp, D. J., 830.
 Tripp, E. H., 707.
 Trout, S. A., 841.
 Trouvelot, B., 650.
 Trowbridge, E. A., 60, 61.
 Truche, C., 171.
 True, A. C., 4, 88, 301, 303.
 Trullinger, R. W., 88, 567, 571.
 Truninger, E., 417.
 Tryon, H., 858.
 Tsai, L. S., 897.
 Tschermak, L., 144.
 Tschesnokov, W., 24.
 Tucker, C. M., 747.
 Tucker, J., 223, 224.
 Tucker, R. W. E., 545.
 Tukey, H. B., 740.
 Tulafkov, N., 820.
 Tullis, E. C., 828, 845.
 Tunnichiff, E. A., 300, 900.
 Turandin, F. A., 265.
 Turk, E. E. De, 118, 314, 315, 316, 328, 716.
 Turk, L. M., 17.
 Turabull, D. O., 559.
 Turnbull, J., 611.
 Turner, A. W., 669.
 Turner, C. E., 491.
 Turner, C. W., 29, 70, 71, 72.
 Turner, H. A., 280.
 Turner, J. D., 360.
 Turner, R. G., 493.
 Tutin, F., 445, 448.
 Tuttle, W. W., 516.
 Twinn, C. R., 355.
 Tylor, W. R., 580.
 Tyzzer, E. E., 266, 671.
 Udall, D. H., 260.
 Uhlrand, R. E., 16, 22, 31, 78.
 Uinchanco, L. B., 245.
 Ullian, S. S., 512.
 Ulmansky, S., 277.
 Ulvesli, O., 802.
 Underhill, F. P., 503, 585, 586.
 Underwood, E. J., 425.
 Underwood, F. L., 385, 386.
 Unwin, C. W. J., 143.
 Urbahn, T. D., 358.
 Uren, A. W., 73.
 Usinger, A., 462.
 Uvarov, B. P., 611, 613, 850.
 Vahlteich, H. W., 306.
 Vail, J. G., 707.
 Valenzuela, A., 584, 686.
 Valerio, B. G., 171.
 Valley, G., 775.
 Valter, L. S. K., 318.
 Van Alstyne, L. M., 738.
 Vance, A. M., 248, 453.
 Vance, R. B., 280, 580.
 van Dam, W., 166.
 Vandel, A., 241.
 Van Deman, R., 795.
 van der Flaas, D. L., 450.
 van der Goot, P., 450.
 van der Meulen, P. A., 656.
 Van Donk, E., 191.
 Van Duzee, E. P., 649, 650.
 Van Dyke, E. C., 648.
 Van Elden, H., 723, 734, 735.
 Van Es, L., 560, 877.
 van Ginneken, P. J., 277.
 Van Hall, C. J. J., 528.
 van Kampen, 539.
 Van Leeuwen, E. R., 656.
 Van Name, W. G., 843.
 van Niekerk, J., 503.
 Van Peenan, H., 516.
 Van Rensselaer, M., 89, 200.
 Vansell, G. H., 139, 753.
 Van Tyne, J., 240.
 Van Volkenberg, H. L., 771.
 van Wijk, A., 502, 804.
 van Zwaluwenberg, R. H., 852.
 Varas Catalá, J., 165.
 Varela, B., 96.
 Varrell, M. W., 11.
 Vasey, A. J., 424.
 Vasin, A. N., 542.
 Vasin, A. N., 542.
 Vaughan, H. W., 499.
 Vaughan, L. M., 276.
 Vaughn, W. E., 11.
 Vawter, L. R., 74, 76.
 Vayssière, P., 647.
 Veale, P. O., 556.
 Veatch, J. O., 116.
 Veihmeyer, F. J., 527, 617, 727, 777, 778.
 Veitch, R., 154.
 Venkataraman, K., 446.
 Verbeck, R. H., 88.
 Vercler, H. R., 223.
 Verity, R., 648.
 Vernon, W. M., 275, 474, 532.
 Viala, P., 849.
 Vickery, H. B., 833.
 Vickery, R. A., 357.
 Victor, B., 673.
 Viemont, B. M., 508, 794.
 Vietinghoff-Riesch, A. F. von, 450.
 Vigfusson, V. A., 568, 569.
 Villegas, V., 658.
 Villiers, F. J. de, 141.
 Vinall, H. N., 35, 130.
 Vincenzo, P., 277.
 Vitales, H., 486.
 Vlodavets, V. I., 799.
 Voge, C. I. B., 262.
 Vogt, E., 692.
 Volcani, I. E., 181, 890.
 Volkovich, S. I., 799.
 Volk, A., 146.
 Volkmar, F., 566, 776.
 Vollmer, H., 898.
 Voorhies, E. C., 280.
 Voukassovitch, P., 548.
 Voženilek, J., 276.
 Fridhachalam, P. N., 407.
 Vuyst, A. M. De, 278.
 Vuyst, P. De, 278, 486.
 Wachtel, M., 495.
 Waddell, J., 191, 688.
 Wade, J. S., 248, 450.
 Wadley, F. M., 544.
 Waggoner, C. S., 190.
 Waggoner, J. E., 571.
 Wagle, P. V., 231.
 Wahlenberg, W. G., 743.
 Wablich, A., 311.
 Waite, R. H., 163.
 Waite, W. C., 572.
 Wakeley, P. C., 649.
 Waksman, S. A., 414, 814.
 Walbridge, N. L., 319.
 Waldauer, A. D., 682.
 Walden, P., 310.
 Waldo, G. F., 140.
 Waldron, L. B., 523, 644.
 Waldschmidt-Leitz, E., 309.
 Walker, A. B., 774.
 Walker, A. L., 257.
 Walker, C. R., 157.
 Walker, D. J., 297.
 Walker, G. K., 167.
 Walker, G. P., 541.
 Walker, H. B., 384, 474.
 Walker, J. C., 237.
 Walker, L. S., 213, 760.

- Walker, M. H., 546.
 Walker, M. N., 400.
 Walker, U. W. F., 875.
 Walker, W. P., 341, 357.
 Wallace, B. A., 579.
 Wallace, G. I., 667.
 Wallace, H. F., 31, 38, 127, 137.
 Wallace, R. H., 23.
 Wallace, T., 838, 839.
 Wallis-Taylor, A. J., 571.
 Walster, H. L., 413.
 Walter, A., 611.
 Walter, A. A., 223.
 Walters, F. M., 710.
 Walther, L. S. K., 318.
 Walton, C. L., 448, 857.
 Walton, G. P., 121.
 Walton, R. P., 309.
 Walton, T. O., 6.
 Walton, W. R., 545.
 Waults, C. C., 869, 872.
 Wang, C. C., 490.
 Wann, F. B., 836, 849.
 Warburton, C. W., 6, 682.
 Warcollier, 206.
 Ward, F. E., 90.
 Ward, F. K., 639.
 Ward, R. A., 682.
 Ward, R. DeC., 208, 313.
 Ward, T. C., 862.
 Wardlaw, C. W., 238.
 Ware, J. O., 27, 828, 845.
 Ware, W. M., 49, 532, 537.
 Warner, E. P., 200.
 Warner, J. D., 507.
 Warner, K. F., 499.
 Warren, D. C., 215, 421.
 Warwick, B. L., 900.
 Wasmann, E., 450.
 Watanabe, K., 620, 648.
 Watenpugh, H. N., 317.
 Waterhouse, W. L., 845.
 Waterman, R. E., 113.
 Waters, C. W., 643.
 Waterspout, A., 209.
 Waterston, J., 159, 360, 649, 853.
 Watkins, H. R., 310.
 Watkins, J. A., 670.
 Watkins, R. L., 275, 552.
 Watkins, W. B., 760.
 Watkins, W. I., 117, 71.
 Watson, C., 594.
 Watson, E. A., 772.
 Watson, E. B., 18.
 Watson, J. R., 343, 351.
 Watson, L. R., 650.
 Watson, P. D., 464.
 Watson, R. V., 193.
 Watt, W. O., 862.
 Watts, R. L., 399.
 Watts, V. M., 828, 835.
 Waugh, F. V., 576.
 Weatherby, L. S., 193.
 Weatherwax, P., 428.
 Weaver, C. H., 772.
 Weaver, E., 462.
 Weaver, H. J., 564.
 Weaver, L. A., 64.
 Weber, 539.
 Weber, C. W., 70, 72.
 Weber, G. F., 343, 344.
 Weber, H., 149, 162.
 Weber, M., 446.
 Webster, L. T., 670.
 Webster, T. A., 113, 114, 588.
 Wedgworth, H. H., 145.
 Weed, A., 649.
 Weeks, D., 573.
 Weems, J. B., 697.
 Wehrle, L. P., 57, 452.
 Welmer, J. L., 48, 49, 747.
 Weirard, F. F., 337, 338, 353.
 Weinstein, A., 215.
 Weinstock, M., 694.
 Weiss, F., 349, 847.
 Welch, H., 164.
 Weldin, J. C., 564.
 Wellington, R., 528, 738.
 Wells, H. M., 498.
 Wells, J. E., jr., 682.
 Welsh, M. F., 772.
 Welton, F. A., 45, 136, 334.
 Wenner, G. F., 426.
 Werner, H. O., 223, 224, 732, 748, 847, 848.
 Werth, E., 47.
 Wertheim, E., 608, 609.
 Wertz, V. R., 677.
 Wéry, G., 409.
 Wessels, P. H., 224.
 West, C., 840, 841.
 West, C. H., 484.
 West, E., 344.
 West, J. H., 692.
 West, R. O., 88.
 Westcott, L. E., 791.
 Wester, P. J., 686.
 Weston, W., 893.
 Weston, W. H., jr., 443.
 Westveld, M., 144, 844.
 Werzel, K., 24.
 Wetzel, R., 827.
 Wheeler, G. A., 595.
 Wheeler, W. M., 647.
 Wheeler, W. P., 68.
 Whetzel, H. H., 646.
 Whitaker, C. F., 524.
 Whitaker, R., 871.
 Whitby, G. S., 805.
 Whitcomb, W., jr., 58.
 Whitcomb, W. D., 250.
 Whitcomb, W. O., 136.
 White, G. C., 371.
 White, G. F., 543.
 White, H. C., 558.
 White, H. L., 259.
 White, J. W., 130.
 White, M. K., 870.
 White, T. H., 339.
 White, W., 258.
 White, W. W., 553.
 Whitehead, R. W., 506.
 Whitehouse, W. E., 341, 387.
 Whitfield, F. G. S., 853.
 Whitfield, W. R., 275, 552.
 Whiting, L. D., 489.
 Whiting, P. W., 214, 457.
 Whitney, E. N., 809.
 Whittmore, M., 598.
 Whittier, E. O., 9, 556.
 Whittle, C. A., 99.
 Wiancko, A. T., 317.
 Wichers, H. E., 674.
 Widmayer, F. J., 556.
 Wiebe, G. A., 727.
 Wiercking, E. H., 276, 573.
 Wiegner, G., 160.
 Wieland, E., 496.
 Wieringa, G., 136.
 Wierzchowski, Z., 792.
 Wieser, G., 23.
 Wiggins, C. B., 834, 835.
 Wiggins, C. C., 741.
 Wiggins, R. G., 522.
 Wiggin, W. W., 42, 143, 639.
 Wight, A. E., 773.
 Wigod, S., 516.
 Wijk, A. van, 502, 804.
 Wilcox, A. N., 525.
 Wilcox, J. C., 481.
 Wilcox, R. H., 355, 380.
 Wilder, T. S., 694.
 Wildermuth, R., 117.
 Wildt, J. C. deR. de, 163.
 Wileden, A. F., 784.
 Wiley, H. W., 100.
 Wiley, J. R., 500.
 Wilgus, H. S., 759.
 Wilhite, F. M., 328.
 Wilke, S., 47.
 Wilkinson, A. E., 228.
 Wilkinson, D. S., 359, 360, 547.
 Will, A., 462.
 Willaman, J. J., 132, 330.
 Willard, A. C., 674, 884.
 Willard, C. J., 634.
 Willard, J. D., 486.
 Willard, R. E., 783.
 Willaume, F., 355.
 Wille, J., 544.
 William, O. S., 69, 461, 760.
 Williams, A. W., 259.
 Williams, B. H., 714.
 Williams, C. B., 487, 615.
 Williams, F. X., 853.
 Williams, H., 682.
 Williams, L. L., 753, 754.
 Williams, P. S., 370.
 Williams, R. E., 397.
 Williams, R. R., 113.
 Williams, W., 797.

- Williams, W. L., 264.
 Williams, Z., 95.
 Williamson, J. T., 732.
 Williamson, R. V., 370.
 Williamson, W. T. H., 122.
 Willier, J. G., 427.
 Willingwyre, G. T., 460.
 Willis, R. L., 524.
 Willmann, F. J., 143.
 Wilson, B. H., 325.
 Wilson, G. F., 543.
 Wilson, H. F., 58.
 Wilson, H. K., 518.
 Wilson, H. L., 258.
 Wilson, J. D., 644.
 Wilson, J. K., 130, 431, 628.
 Wilson, J. R., 92.
 Wilson, J. W., 400.
 Wilson, M., 496.
 Wilson, M. L., 100, 572.
 Wilson, R., 144.
 Wilson, W. R., 875.
 Wilster, G., 873.
 Winder, M. S., 682.
 Winkleman, E., 214.
 Winkler, A. J., 140, 735.
 Winter, A. R., 461, 551.
 Winter, F. L., 34, 327, 328.
 Winter, J. D., 451.
 Winterbottom, J. M., 824.
 Wise, E. C., 791.
 Wislocki, G. B., 726.
 Wissler, C., 580.
 Woglum, R. S., 448, 449, 451.
 Wolcott, G. N., 246, 647, 852.
 Wolf, J. G., 833.
 Wolfanger, L. A., 115, 714.
 Wolff, M., 278.
 Wolochow, D., 568, 569.
 Wood, A. A., 541.
 Wood, B. M., 657.
 Wood, H. B., 555.
 Wood, J. B., jr., 178.
 Wood, R. D., 115.
 Wood, T. B., 425, 459, 862.
 Woodbridge, M. E., 136.
 Woodman, H. E., 424, 865.
 Woodruff, H. A., 470, 669.
 Woods, A. F., 4, 88, 102.
 Woods, J. J., 151.
 Woodside, J. W., 443.
 Woodward, J. S., 143.
 Woodworth, C. M., 327, 328, 329, 346, 622.
 Woodworth, R. H., 510.
 Woodworth, R. S., 580.
 Wooley, J. C., 77, 78.
 Woolf, D. O., 271.
 Working, E. B., 698.
 Working, E. J., 884.
 Working, H., 888.
 Works, G. A., 7.
 Worner, R. K., 695.
 Worsley, R. R. LeG., 811.
 Worth, J., 572.
 Worthley, H. N., 353, 354.
 Wriedt, C., 216, 421, 422, 824.
 Wright, A. C., 174.
 Wright, A. H., 571, 629.
 Wright, C. C., 271.
 Wright, J. C., 186.
 Wright, N. C., 871.
 Wright, R. C., 26.
 Wright, S., 513.
 Wu, H., 91.
 Wülker, G., 240.
 Wymore, F. H., 248, 753.
 Yakimoff, W. L., 170, 469.
 Yale, M. W., 373.
 Yamaguti, Y., 620.
 Yamasaki, M., 800.
 Yapp, W. W., 323, 369, 370.
 Yarnell, S. H., 900.
 Yates, H. O., jr., 45.
 Yeatman, F. W., 90, 287.
 Yochem, D. E., 515.
 Yoder, F. R., 87, 187, 580.
 Yoshimura, K., 202.
 Yothers, M. A., 653, 654.
 Yothers, W. W., 647.
 Young, A., 62, 74.
 Young, A. A., 580.
 Young, A. L., 381, 382, 759.
 Young, B. P., 171.
 Young, C. C., 358.
 Young, D. K., 681.
 Young, F. D., 505.
 Young, H. C., 351, 645.
 Young, H. D., 152, 448, 510.
 Young, V. H., 845.
 Young, W. C., 125.
 Youngblood, B., 102, 103, 200, 572.
 Youngs, F. O., 19.
 Youtz, J. E., 193.
 Yung-Tai, T., 856.
 Yutuc, L. M., 774.
 Zacher, F., 250.
 Zaleski, L., 121.
 Zapoleon, L. B., 711.
 Zaratan, A. M., 662.
 Zebrowska, W., 278.
 Zeimet, A., 123.
 Zeissig, A., 260.
 Zeleny, L., 330.
 Zilva, S. S., 803.
 Zimmerman, C. C., 286, 389, 580, 684, 685, 890.
 Zimmerman, P., 682.
 Zimmerman, P. W., 438.
 Zimmermann, A., 852.
 Zink, J. D., 682.
 Zinzallan, G., 461.
 Znojko, D. V., 242.
 Znojko, D. V., 242.
 Zödlér, H., 673.
 Zorbaugh, G. S. M., 885.
 Zorin, L. M., 242.
 Zorin, P. V., 242.
 Zorn, W., 800.
 Zwaluwenberg, R. H. van, 852.
 Zwick, W., 566.
 Zychlinski, J., 277.

INDEX OF SUBJECTS

NOTE.—The abbreviations "Ala.," "Conn.State," "Mass.," etc., after entries refer to the publications of the respective State experiment stations; "Alaska," "Guam," "Hawaii," "P. R.," and "V. I." to those of the experiment stations in Alaska, Guam, Hawaii, Porto Rico, and Virgin Islands; "Can." to those of the experiment stations in Canada; and "U.S.D.A." to those of this Department.

- Abdelloides marquesi* n.g. and n.sp., description, 155.
- Abbreviations in original descriptions, protest against use, 647.
- Abortion—
- agglutination test, collection of blood for, Ill., 263.
 - agglutination test, relation to agglutinins in sera, 75.
 - and sterility studies, Ky., 262.
 - bibliography, 263.
 - carrier problem, Calif., 770.
 - control, papers on, 280, 555, 668.
 - control, progress in Connecticut, 773.
 - control project, Ill., 374.
 - epizootic, and undulant fever, relation, 262.
 - epizootic, summary, 875.
 - eradication, West.Wash., 558.
 - in cattle, control, 263; Del., 468; Tex., 666.
 - in cattle, diagnosis, 876.
 - in cattle, vaccination with living cultures, 559.
 - in fowls, 471.
 - spread, relation of bull to, 260, 263.
 - vaccination, problem, Mich., 469.
 - (See also *Bacterium abortum*, *Brucella abortus* and *Alcaligenes abortus*.)
- Abortus-melitensis* group, fermentation of carbohydrates by, 772.
- Acacia glaucescens* poisonous to livestock, 558.
- Acaila hastiana* on osiers in Czechoslovakia, 648.
- Accessory food factors. (See Vitamins.)
- Achatodes zeae* parasites, bionomic notes, 545.
- Acid lead arsenate composition, relation to arsenical injury, 55.
- Acidosis of pregnant ewes, Ky., 254.
- Acrididae control in Russia, 649.
- Acriflavine treatment for undulant fever, 468.
- Acrostalagmus aphidum*, fungus parasite of aphids, 246.
- Actinomyces dermatonomus* n.sp., notes, 689.
- Actinomyces* on roots of cannabis, Del., 746.
- Actinophora fragrans* trees, wholesale destruction by buprestid borer, 157.
- Adelphocoris rapidus*, effect on cotton plant, 653.
- Adobe construction, studies, Calif., 80.
- Aedes*—
- aegypti*. (See Yellow fever mosquitoes.)
 - fasciata*, anthrax transmission experiments, 168.
 - flavescens*, life history, 856.
- Aegeria*—
- exitiosa*. (See Peach borer.)
 - rignae* n.sp., description, 545.
- Aegeria webberi* host relations, 360.
- Aenopler carpocapsae*, parasite of codling moth, Del., 754.
- Aethalon reticulatum*, morphology and biology, 155.
- Agalaxia, sheep and goat, control, 170.
- Agglutination test for abortion, technic, 260.
- Agglutinins, nonspecific, in bovine sera, 75.
- Agonoscelus versicolor*, studies, 853.
- Agrarian—
- Bank Act of Kingdom of Serbs, Croats, and Slovenes, 181.
 - reform in Egypt, 276.
 - reform in Hungary, operation and results, 180.
 - reform in Latvia, social aspects, 180.
 - reforms in central Europe, 276.
 - revolution, Mexican, treatise, 233.
- Agricultural—
- acts of Parliament relating to Scotland, 180.
 - chemistry. (See Chemistry.)
 - colleges, papers on, 88.
 - (See also Kansas, Michigan, etc.)
 - cooperation in Latin countries, 181.
 - cooperation, papers on, 277.
 - credit and finance, Ky., 278.
 - credit handbook, Philippine, 484.
 - credit of South Carolina, S.C., 676.
 - credit, use, value, and cost, Calif., 484.
 - depression, papers on, 885.
 - distribution, adjusting to market demands, West.Wash., 887.
 - economics—
 - in United States, impressions, 885.
 - papers on, 276, 480.
 - research in, developing, 88.

Agricultural—Continued.

economics—continued.

Society conferences, proceedings, 885.

Society, report, 480.

textbook, 187.

education—

an "outsider's" view, editorial, 301.

in United States, treatise, 390.

vocational, course of study, determination, 187.

vocational, course of study in high school, 685.

vocational, proposed program of research, 890.

(See also Agricultural colleges, Agricultural instruction, and Agricultural schools.)

engineering. (See Engineering.)

experiment stations. (See Experiment stations.)

extension. (See Extension.)

implement design, Ala., 78.

income, leading sources in State, Ohio, 677.

information service, foreign, 884.

instruction, standards, 88.

(See also Agricultural education and Agricultural schools.)

interests of Virginia, report of commission studying, 580.

journals, new, 700, 799.

labor, wages, index numbers, Ohio, 387, 677.

(See also Labor.)

law, Rumanian, papers on, 276.

leadership, training for, 88.

machinery and equipment, treatise, 382.

Marketing Act, wheat under, 484.

markets, organization, effect on prices, 276.

meteorology, cooperation in, editorial, 401.

meteorology, organization in Indo-China, 409.

outlook for Oklahoma, Okla., 784.

output of Great Britain, 890.

output of Northern Ireland, 880.

producers, organized, cooperation with, 88.

production, adjusting to market demands, W.Va., 887.

production, index numbers, Ohio, 387, 677.

products—

British, canning, 518.

color measurement, U.S.D.A., 503.

imports, U.S.D.A., 389.

international trade in, 276.

marketing. (See Marketing.)

of North Dakota, prices, N.Dak., 783.

of Ohio farms, gross cash income from, 678.

Agricultural—Continued.

products—continued.

prices, historical study, Va., 784.

surpluses, care of, 276.

records, papers on, 276.

research, papers on, 88.

schools, vocational, relation to cooperation, 681.

statistics for 1928, Ohio, 286.

statistics, international, terminology and bases for, 582.

statistics, international yearbook, 582.

statistics of Germany, obtaining, 277.

statistics of Great Britain, 487.

survey of Danube Basin, U.S.D.A., 283.

survey of Hungary, U.S.D.A., 889.

survey of Switzerland, U.S.D.A., 283.

trade with Philippines, U.S.D.A., 388.

work, scientific organization, papers on, 276.

Agriculture—

and climate in Russia, 712.

and roads, relation, N.Y.Cornell, 278.

Department of. (See United States Department of Agriculture.)

electricity in. (See Electricity.)

for rural teachers, textbook, 487.

in England, relation to foreign competition, 885.

Inter-American Conference on, notes, 400.

mechanization, 885.

scientific and technical societies dealing with, 88.

women in, contribution 278.

Agriothmas agrestis, notes, West. Wash., 541.

Agromyza simplex. (See *Asparagus minor*.)

Agronomic research, outstanding results, 518.

Agropyron seeds, comparative morphology, 430.

Agrotis. (See Cutworms.)

Alabama argillacea in West Indies, 647.

Alaska Stations, report, 199.

Albumin, egg, pH changes during incubation, 827.

Alicaligines—

abortus from spinal fluid of child, 261.

(See also *Bacterium abortum*, *Brucella abortus*, and Abortion.)

melitensis. (See *Brucella melitensis*.)

Alcohol, power, from sisal waste, 672.

Aleurocanthus uogiumi. (See Citrus black fly.)

Aleurodidae on citrus in Far East and parasites, 155.

Aleyrodes citri. (See White fly, citrus.)

Alfalfa—

anthracnose resistant varieties, Miss., 145.

as principal ration, physiological effect, 870.

breeding, N.Y.Cornell, 781.

culture experiments, N.Dak., 129; P.R., 731.

Alfalfa—Continued.

- cutting experiments, Ark., 828; Calif., 727; Del., 728.
- effect of phosphatic fertilizers, Mont., 210.
- experiments, Ark., 33.
- fertilizer experiments, Miss., 128.
- ground, feeding value, Ohio, 65.
- growth and root development, effect of reactions of subsoil, Pa., 317.
- hay as sole ration for dairy cattle, effect, Nev., 72.
- hay, cost of production, Nev., 575.
- hay, drying artificially, 176.
- hay, feeding value, variability, Mich., 458.
- hay, Ladak, notes, Mont., 219.
- hay, proteins in, biological value, 637.
- insects affecting, Nev., 55.
- leaf meal, effect on egg production and fertility, Ark., 868.
- potassium in, variations, 220.
- root injuries from freezing, 747.
- seeds, hard, agricultural value, 136.
- seeds of different shapes, value, 136.
- seeds, quality, Mich., 426.
- stands, permanency, 425.
- varieties, Mich., 426.
- variety tests, Del., 728; Ill., 328; N.Dak., 129; Tex., 626.
- weevil parasites, value, Nev., 55.
- weevil spread through medium of alfalfa hay and meal, 158.
- weevil, studies, Wyo., 546.
- wilt, notes, 145.
- wilt-producing fungus, host plants, 48.
- wilt-producing organism, temperature and moisture relations, 747.
- winterkilling, 49.
- yellow, relation to leafhopper, Ky., 355.

Alkali—

- cleaning solutions, controls, 873.
- poisoning, studies, Nev., 74.
- soils, electrolytes affecting reaction in, 119.
- soils, studies, Calif., 718.

Allantonema picea n.sp., description, 547.

Allelomorphs, multiple, additive influence, 322.

Alligators, habits and economic importance, U.S.D.A., 750.

Almond—

- Anthonomus, notes, 154.
- seedlings, *Thielavia basicola* affecting, 145.

Almonds, composition, Calif., 786.

Alnus, cytological studies, 610.

Alternaria—

- dianthi*, notes, 52.
- humicola*, notes, 538.
- palandui* n.sp., notes, 536.
- solani*, notes, 237; Fla., 344, 345.
- sp., notes, 145.

Alternaria leaf spot—

- of cotton, 443.
 - of tobacco, Fla., 345.
- Alum soil of Finland, electrolytes affecting reaction in, 119.

Aluminum—

- effect on mortar strength, 271.
- hydroxide, dehydration by ignition, 506.
- in normal nutrition, 585.
- in plant and animal matter, 190.
- metabolism, 503, 585.
- phosphate, dehydration by ignition, 506.
- salts, effect on pineapple plants in water culture, Hawaii Pineapple Cannery, 419.
- salts, injection, toxic effects, 586.
- toxicity to plants, 620.

Alysia manducator, notes, 860.

American—

- Dairy Science Association, proceedings, 164, 874.
- Farm Economic Association, papers and discussions, 276, 572, 884.
- Institute of Cooperation, papers and discussions, 681.
- Society of Animal Production, meeting, 499.
- Sociological Society, papers and proceedings, 579.

Ammonia—

- oxidation, gauze catalyst in, 11.
- production in soils, Mo., 17.

Ammonium salts, physiological reaction, 119.

Amorbia essigana n.sp., description, 855.

Amphorophora rubi, notes, Minn., 451.

Amphorophora rubicola, notes, Minn., 451.

Anabrus implic. (See Cricket, Mormon.)

Anserobes—

- new pathogenic, from wound infection, 280.
- pathogenic spore-bearing, in sheep carcasses, 562.

Anaplasma, nature of, 561.

Anaplasmosis—

- in bulls being immunized against Texas fever, Tex., 666.
- in cattle, studies, 561.
- in sheep in Russia, 170.
- studies, Calif., 770.

Anastrepha fraterculus. (See Fruit fly, West Indian.)

Anchylopera angulifasciana, studies, N.Y. Cornell, 452.

Anemia—

- in cattle and sheep, phosphorus partition of blood in, 865.
- in pigs, prevention, Ill., 365.
- in rats, effect of high doses of iron, 191.
- in suckling pigs, Wis., 367.
- infectious equine. (See Swamp fever.)
- inorganic elements of spinach for, 297, 695.

Anemia—Continued.

- nutritional, blood regeneration in, effect of inorganic elements, 695.
- of animals, blood transfusion for, 467.
- of rice disease, studies, 596.
- pernicious, liver extract for, 191.
- pernicious, treatment with stomach tissue, 398.
- relation to copper deficiency, 191.
- specificity of copper as iron supplement for, 688.

Angora goat industry in the United States, U.S.D.A., 460.

- Angoumois grain moth—
- in stored rice, 542.
- injury to corn, S.C., 651.

Animal—

- breeding, textbook, 213.
- (See also Hybridization and specific animals.)

chromosomes. (See Chromosomes.)

- diseases—
- control, 875.
- in Burma, 772.
- in Canada, 772.
- in Ceylon, 167.
- in Punjab, 875.
- in Rhodesia, 559.
- in tropical countries, 167.
- of the newborn, 260.
- studies, Tex., 666.
- (See also specific diseases.)

fats. (See Fats.)

food, copper in, 190.

Industry, Inter-American Conference on, notes, 400.

numbers relation to climate, 611.

tissues, aluminum in, 190.

tissues, manganese, copper, zinc, and boron in, Ky., 203.

tissues, phosphorus in, 122.

tissues, post-mortem changes in, 161.

Animals—

- color changes in, 514.
- coloration and fly attack, 647.
- domestic, blood of, 260.
- domestic, pigmentation, 324.
- domestic, sterility in, 468.
- domestic, variations in, 421.
- immature, ovarian changes due to stimulation, 826.
- origin of species, effect of earth radiations, Calif., 723.
- protection on national reservations, U.S.D.A., 52.
- rationing, scientific basis, 862.
- sex determination in, 726.
- venomous, and insects of medical importance, treatise, 542.
- vertebrate of northeastern United States, 239.
- (See also Cattle, Livestock, Mammals, Sheep, etc.)

Ankylostoma canina, notes, 265.

Anopheles—

- fuliginosus*, anthrax transmission experiments, 168.

Anopheles—Continued.

maculipennis, food of adult, around Amsterdam, 455.

maculipennis, fungus parasites, 249.

maculipennis spread, effect of wind, 249.

Anopheles—

infection with malaria parasites, 546.

larvae, ecology, 450.

mosquitoes in Porto Rico, 58.

(See also Malaria and Mosquitoes.)

Anophelism without malaria around Amsterdam, 455.

Anorexia in childhood, chronic, 893.

Anthelmintics, tests with sheep, 877.

Anthar smut, biological forms, 146.

Anthraxa pernyi, nosematosis, 450.

Anthocyan pigments in rice varieties, distribution, 429.

Anthocyan in grapes, N.Y.State, 9.

Anthonomus—

grandis. (See Boll weevil.)

ornatus, notes, 154.

quadrigibbus. (See Apple curculio.)

Anthrax—

in Great Britain, data, 260.

infected hides, disinfection, 167.

symptomatic. (See Blackleg.)

transmission experiments, 167.

values of anti-anthrax serum and neosalvarsan, 773.

Antimony—

electrode for determining pH and lime requirement of soils, 407.

trichloride test for vitamin A, 111, 112.

Antineuritic vitamin. (See Vitamin.)

Antirachitic. (See Rickets and Vitamin D.)

Antirrhinum, inbred strains, rust resistance, Calif., 724.

Antiscorbutic vitamin. (See Vitamin C.)

Ants—

biology, 440.

economical value for forests, 647.

invasions, control, Conn.State, 599.

leaf-cutting, phorids parasitizing, 858.

mound-building, associated with tree-hoppers, 861.

mounds of, populations, 159.

of Mississippi, Miss., 153.

on citrus trees, control, Tex., 652.

red forest, biology, 450.

white. (See Termites.)

Apanteles, Indo-Australian species, revision, 359.

Apanteles—

nonagiae, economic value, 546.

tirathabae n.sp., description, 360.

Apate carmelita, notes, 542.

Aphanomyces root rot, notes, 146.

Aphelenchus ritzema-bosi, notes, 149.

Aphelinus—

fuoundus, notes, 861.

mali, biology, 56.

mali, establishment in many parts of world, 861.

mali in Switzerland, 155.

Aphid preparations, microscopic, making, 650.

Aphidencyrus inquisitor, notes, 861.

Aphids—

fungus parasite of, 246.

transmission of plant viruses, studies, 854.

woolly, parasite, biology, 56.

(See also Apple aphid, woolly.)

Aphis—

gossypii. (See Cotton aphid.)

leguminosae, notes, 237.

maidis. (See Corn leaf aphid.)

persicae. (See Peach aphid, green.)

pomi. (See Apple aphid.)

rubicola, notes, Minn., 451.

spiraeicola, food plants of, 246.

spiraeicola, notes, Fla., 351.

Apiculture. (See Beekeeping.)

Apion spp., control on red clover, 58.

Aplanobacter insidiosus, notes, 145.

Aplocheilus latipes, genetical studies, 621.

Apoplexy, parturient. (See Milk fever.)

Apparatus—

constant temperature and humidity chambers, 615.

evaporating, condensing, and cooling, 174.

flame-projecting, for use against locusts, 853.

for continuous extraction of small quantities of fluid, 607.

for determination of carbon dioxide in respiration of apples, 139, 615.

for determination of nitrogen in yeast, 312.

for gas-liquid reactions, 806.

for measurement of basal heat production, 597.

for pipetting serum, 565.

for plant growth in controlled environment, 615.

portable pH, description, 11.

used in testing bacillary white diarrhea carriers, 671.

Appetite, loss of. (See Anorexia.)

Apple—

aphid, food plants, 246.

aphid, green, paper on, 540.

aphid, woolly, establishment in many parts of world, 861.

aphid, woolly, parasite, in Switzerland, 155.

(See also Aphids, woolly.)

blight, control, Ky., 234.

blister canker, studies, Ill., 346, 749.

blossoms, abscission, Del., 750.

butter, quality, Ohio, 686.

canker of headworked trees, 536.

chlorosis, treatment, 849.

curculio control by hogs, Iowa, 358.

cuttings, rooting, Del., 736.

diseases and insects, control, N.Y.Cornell, 740.

fire blight, control, Ark., 845.

fire blight in Wisconsin, 350.

flower bud, differentiation, 840.

Apple—Continued.

fruit buds, development, Ark., 835.

fruit spot, outbreak, N.Y.State, 439.

growers, economic research as aid to, 89.

insects, control, Pa., 353.

insects, dust-spraying project for control, Mo., 54.

juices, sulfurous acid in, determination, 206.

leafhopper on alfalfa, control, Ill., 352.

leaves, leaching with cold water, 838.

maggot outbreak, 541.

measles, cause and control, Ill., 346.

pollen, longevity and viability, 525.

pollen sterility, studies, 321.

root borer, giant, notes, S.C., 651.

root rot, notes, Tex., 637.

rust on host tissue in culture dishes, 645.

rust outbreaks in Hudson Valley, N.Y. Cornell, 746.

scab, control, Pa., 347.

scab, effect of sulfur dusts, Ill., 346.

scab, notes, 238.

scab spraying experiments, 532.

seedlings, cause of hairy root on, 434.

seedlings, data, Can., 524.

silver leaf, notes, 445.

species, hybrids between, 528.

sucker, studies, 56.

tree collar rot, Wash.Col., 536.

tree growth, role of subsoil in, U.S.D.A., 716.

trees, biennial, leaf area of spurs on, 139.

trees, bridge grafting and inarching, value, N.Y.State, 439.

trees, effects of deficiencies of potassium, calcium, and magnesium, 839.

trees, movement of fat and nitrogen in, Mo., 39.

trees, propagation and transplanting, Can., 836.

trees, pruning, Ill., 229.

trees, ringing value, Ohio, 41.

trees, sod culture, Ohio, 638.

trees, stock and scion observations, Wis., 43.

trees, young, training, Pa., 338.

Apples—

arsenical residue on, N.Y.State, 431.

Australian, exported to England, waste in, 850.

breeding, 139; Ill., 335; Mo., 39; N.Y. State 431.

changes in respiratory activity, 840.

classification according to blight susceptibility, Miss., 187.

cold storage studies, 525.

cost of production, N.Y.Cornell, 781.

crab. (See Crab apple.)

faulty grafts in, Mich., 434.

fertilizer experiments, 525; Can., 638; Ill., 336; N.Y.State, 740; Ohio, 40.

fruit dropping of early and late varieties, Del., 750.

Apples—Continued.

- fruit setting studies, Mo., 39; Ohio, 41.
 - grass mulch v. tillage-cover crops for, Ohio, 40.
 - market supplies and prices, U.S.D.A., 578.
 - mite affecting, 360.
 - new or noteworthy varieties, N.Y.State, 738.
 - packing in boxes, Ohio, 386.
 - pectic constituents, changes in, 434.
 - pollen tube growth, Ark., 834.
 - pollination, effect of sulfur dusts, N.Y. Cornell, 840.
 - pollination studies, 230, 434; Mo., 39; N.Y.Cornell, 736; N.Y.State, 738; S.C., 635.
 - prices, yields, and acreages by varieties, N.Y.Cornell, 733.
 - propagation studies, N.Y.State, 431.
 - pruning, effect, Ill., 336; Ohio, 40.
 - quality and maturity studies, 340.
 - respiration, apparatus for study, 139, 615.
 - seedling stocks, N.Y.State, 432.
 - setting, factors affecting, N.Y.Cornell, 739.
 - shipping, Ill., 336.
 - spray residue removal from, N.Y.State, 740, 741.
 - spraying and dusting experiments, Ohio, 41.
 - storage in artificial atmosphere, 841.
 - storage temperatures and costs, Ind., 38.
 - storage, wraps for, Ohio, 41.
 - thinning, Ohio, 41.
 - varieties as cross pollinizers, 525.
 - varieties in West Virginia, W.Va., 228.
 - variety tests, Miss., 38.
 - vitamin C in, Mo., 95.
 - yield, correlation with trunk measurements, 229.
 - yields, Ohio, 40.
- Apricot—
- chlorosis, treatment, Calif., 745.
 - green rot, notes, Calif., 745.
 - trees, effect of nitrogen, Calif., 734.
 - trees, tracheal sap, seasonal changes in, 433.
- Apricots—
- codling moth infestation, 156.
 - growth and fruit production, correlations, 140.
 - pruning data, Calif., 734.
 - pruning, types, Can., 638.
 - shipping quality relation to picking condition, Can., 638.
- Arabinose fermentation by organisms from tomato products, N.Y.State, 10.
- Arachis hypogaea* slime disease, rotation test, 50.
- Areca nut bleeding disease, 238.
- Arginine feeding and creatine-creatinine excretion in man, 693.
- Arkansas Station, report, 899.

Armigeres obturbans—

- anthrax transmission experiments, 168, notes, 454.
- Armilaria on orange roots, control, Calif., 744.
- Army worm—
- fall, in Texas, U.S.D.A., 357.
 - fall, injury to late corn, S.C., 651.
 - in Russia, 542.
 - semiotropical, on sweetpotatoes in storage, 241.
- Arrow grass poisonous to livestock, U.S.D.A., 74.
- Arsenates, compatibilities with fluosilicates and cryolite, 653.
- Arsenic poisoning as sequel of bone chewing in cattle, 467.
- Arsenical—
- poisoning in the field, 562.
 - residues on apples, studies, N.Y.State, 740.
 - residues, problem, papers on, 649.
 - residues, removal, new solvents for, 433.
- Arthritis in pigeons, 269.
- Arthropoda—
- cephalic segments, 649.
 - Namooan terrestrial, 852.
- Arthropods—
- in transmission of tularemia, 650.
 - poisonous, of North and Central America, 648.
- Artichoke powder, diabetic food value, 791.
- Artichokes in Limousin, 836.
- Asaphes americana*, notes, 861.
- Ascarid infestation of pigs, Ill., 375.
- Ascaridia lineata*, control, 566.
- Ascarids of animals and man, moisture requirements of eggs, 240.
- Ascaris extracts, cutaneous and precipitin tests with, 875.
- Ascaris lumbricoides*, moisture requirements of eggs, 240.
- Ascaris suum*, moisture requirements of eggs, 240.
- Ascogaster carpocapsae*, parasite of codling moth, Del., 754.
- Ash determination by direct weighing, 712.
- Ash substances, passage into a plant, 820.
- Asiatic beetle—
- in lawns, control, Conn.State, 599.
 - quarantine, Conn.State, 599.
- Asparagus—
- beetle, studies, S.C., 650.
 - breeding in Schwetzingen, 432.
 - cutting during first year, effect, Ill., 337.
 - effect of cold winter weather, Fla., 335.
 - effect of heavy applications of manure, N.Y.Cornell, 737.
 - fertilizer experiments, Md., 339; S.C., 636.
 - prices, relation to quality, 576.
 - varieties, N.Y.State, 431.

Aspen—

- lands, forest possibilities in Lake States, Minn., 231.
- quaking, value for pulp wood, U.S.D.A., 743.

Aspergillus—

- fumigatus* infection of kidneys, 264.
- niger*, notes, 145.
- spp., effect on mealybugs, Calif., 744.
- spp. in cacao, 149.

Aspidiotus—

- hederæ*. (See Oleander scale.)
- lataniae*, fumigation with chloropicrin, 156.
- perniciosus*. (See San Jose scale.)

Asses, variations in, 421.

Association—

- of Land-Grant Colleges and Universities—
 - convention, editorial, 1.
 - convention, place of research at, 101.
 - officers elected, 1929, 200.
 - proceedings, 88.
- of Official Agricultural Chemists, convention, 100.
- of Official Seed Analysts of North America, proceedings, 135, 136.

Aster wilt, notes, West.Wash., 532.

Aster yellows, notes, West.Wash., 532.

Asters, inheritance of color in, 513.

Atelogglossa cinerea, notes, 241.

Atmospheric moisture. (See Humidity.)

Atractodes gravidus, notes, 860.

Atriplex canescens, hemolytic activity, 74.

Aulacaspis—

- pentagona*. (See Peach scale, white.)
- rusae*. (See Rose scale.)

Avitaminosis, effect on hematopoietic function, 297.

(See also Vitamin deficiency.)

Avocado—

- diseases, studies, Calif., 744.
- leaves, magnesium in, Calif., 745.
- moth, new, description, 855.
- root disease, studies, P.R., 747.
- tipburn, cause, Calif., 745.

Avocadoes—

- Collinson, pollen sterility in, 842.
- histological studies, Calif., 735.
- varieties, cytological studies, Calif., 723.
- vitamin A in, 193.

Bacillus—

- abortus-equinus*, notes, Ky., 262.
- abortus suis*, notes, Ky., 262.
- aertrycke*, endemic infection of guinea pigs with, 667.
- aertrycke*, fatal infection of chicks, 269.
- amylovorus*, life history, Ark., 444.
- amylovorus* within living tissues, 849.
- anthracis*, morphology, variability in, Ark., 874.

Bacillus—Continued.

aroidae and *B. carotovorus*, differentiation by agglutination tests, 235.

atrosepticus, notes, Mo., 47.

botulinus, type B, in damaged silage, 467.

(See also *Clostridium botulinum*.)

carotovorus and *B. aroidae*, differentiation by agglutination tests, 235.

carotovorus growth habits, Pa., 347.

melitensis. (See *Micrococcus melitensis*.)

oedematiens infection in cattle, 562.

oedematiens, notes, 669.

radicicola in soil, longevity, Mo., 17.

(See also Nodule bacteria.)

sordellii and *Clostridium oedematoides*, comparison, 261.

sordellii immunity maternally transmitted, 661.

sordellii in icterohemoglobinuria of cattle in Nevada, 261.

welchii, cause of blackleg in sheep, 773.

Bacillus of Preisz-Nocard, method of infection by, 167.

Bacon hog, handbook, 867.

Bacteremia, metaphen treatment, 360.

Bacteria—

anaerobic. (See Anaerobes.)

behavior in certain soils, N.Y.State, 416.

growing during pasteurization, control, N.Y.State, 373.

heat-loving, in pasteurized milk, N.Y.State, 73.

in commercially prepared infant foods, 392; N.Y.State, 392.

in nasal cavities and middle ear of rats deprived of vitamin A, 493.

in milk, soil, etc. (See Milk, Soil, etc.)

thermophilic, in milk, udder as source, N.Y.State, 768.

Bacterial metabolism, treatise, 707.

Bacteriologic culture media. (See Culture media.)

Bacteriology—

determinative, Bergey's manual, 821.

laboratory guide, 166.

textbook, 259.

treatise, 667, 770.

Bacteriophagy, treatise, 875.

Bacterium—

abortum, resistance of rats, effect of diet, 876.

abortum strains, comparative agglutinating properties, Del., 772.

(See also *Brucella abortus*, *Alcaligenes abortus*, and Abortion.)

anatum, fatal infection of chicks, 269.

campestre, studies, N.Y.State, 748.

campestre-B. phaseoli group, differentiation by agglutination tests, 235.

citri. (See Citrus canker.)

Bacterium—Continued.

- cucurbitae* n.sp., description, 849.
lachrymans, notes, Fla., 344.
leguminosarium growth habits, Pa., 347.
malvacearum development, factors affecting, 441.
marginatum, notes, 538.
marginatum production of crystals in starch media, 320.
melitensis. (See *Micrococcus melitensis*.)
papavericola n.sp., notes, 646.
paraviscosum equi, description, 265.
phaseoli-B. campestris group, differentiation by agglutination tests, 235.
pullorum in tissues of dead chick, viability, 171.
pullorum infection, atypical, in chicks, 268.
 (See also *Salmonella pullorum* and *Pullorum* disease.)
pullorum phasiani, notes, 171.
purificans, notes, 77.
solanacearum in *Arachis hypogaea*, rotation test with, 50.
solanacearum, studies, Fla., 345.
tumefaciens, apple strain of, 50, 51.
tumefaciens, effect of bacteriophage, 347.
tumefaciens in tomato, 146.
tumefaciens, radiations from, 143.
vulgatus, synthesis of vitamin B by, 94.
Bairamella fuscipes n.g. and n.sp., description, 159.
Balaninus—
caryae. (See *Pecan weevil*.)
nucum, notes, 852.
Balanitidium coli, notes, P.R., 771.
Balanitidium, experimental infection of rats, 467.
Balsam fir—
 decay in, 538.
 girdling hardwoods to release, 844.
Banana—
 bunchy top disease in Ceylon, 238.
 root borer, studies, 153.
Bananas—
 beetle affecting, 358.
 castnid moth affecting, 854.
 from Philippines, composition, 686.
 moth affecting, 357.
 yields, V.I., 227.
Barberry—
 eradication, notes, Mont., 234.
 situation in Ontario, 220.
 (See also *Wheat stem rust*.)
Barium fluosilicate, use as insecticide, Tenn., 543.
Bark beetle epidemics, relation to wind-falls, 650.
Bark beetles, fauna of, in Russia, 542.
Barley—
 as pasture supplement for pigs, 163.
 awnless, yield, S.C., 625.
 breeding, N.Y.Cornell, 731.
 combining test, N.Dak., 129.

Barley—Continued.

- ground, for laying hens, S.C., 661.
 harvesting with combine, Minn., 478.
 Illinois 1928 v. northern, feeding value, Ill., 361.
 improvement, Mont., 219.
 inoculation tests with *Ustilago hordei*, Calif., 745.
 leaf rust resistance in crosses, inheritance, 845.
 naked, alcohol soluble proteins, 202.
 scab, control, U.S.D.A., 236.
 scabby, feeding value, Ill., 361.
 smuts, notes, 535.
 variety date-of-seeding experiment, 220.
 variety tests, Alaska, 127; Calif., 727; Ill., 327; Ind., 30; N.Dak., 129; S.C., 625; U.S.D.A., 330.
 yield and composition, effect of different nutrients, 121.
 Barn ventilation, studies, N.Y.Cornell, 780.
Baryodma verna, parasite of onion maggot, Ill., 353.
Basus annulipes, parasite of grape berry moth, Del., 754.
 Bats, British, insect food, 539.
Bean—
 beetle, Mexican—
 control, S.C., 859; Tenn., 758.
 distribution, moisture as factor, 158.
 in Delaware, 455.
 in Ontario, 541.
 in Utah, 455.
 notes, 242.
 studies, S.C., 650.
 diseases, notes, S.C., 642.
 leaf beetle, notes, Ark., 851.
 root rot, new, notes, Miss., 146.
 rots, control, Miss., 145.
 seeds, Lima, injury from seed treatment, N.Y.State, 439.
Beans—
 and rice as sole diet, 583.
 baldhead in, cause, 846.
 breeding, N.Y.Cornell, 731.
 effect of mulching paper, N.Y.Cornell, 737.
 fertilizer experiments, Miss., 138.
 hardshell of, prevention, 136.
 Lima, fertilizer experiments, S.C., 636.
 snap, fertilizer experiments, Miss., 39.
 snap, yellowing disease, Fla., 345.
 spacing experiments, Ill., 337.
 strain tests, Ill., 337.
 string, effect of cooking method on vitamin B in, Mo., 94.
 varieties, N.Dak., 138.
 variety tests, 32.
 yield, relation to planting rate, 524.
 (See also *Soybeans*, *velvetbeans*, etc.)
 Bearings, roller, use in farm equipment, 175.
Beauveria bassiana, notes, 544.

Beavers, mountain, in Pacific Northwest, U.S.D.A., 52.

Bedbugs—

control by spiders, 246.
longevity, 355.

Bee—

culture, German research institute for, 241.
hive temperatures, effect of external temperature, 656.
hives, recording scale for, 59.
larvae infection by *Bacillus larvae*, 251.

Beech, red, in Austria, 144.

Beef—

and beef products, foreign trade in, U.S.D.A., 579.
conditioning or ripening, 161.
from barley and corn, quality, comparison, Ill., 363.
high quality, time required to make, Ill., 363.
muscle, effect on anemia of rice disease, 596.
poor color, causes, Ill., 364.
production in Great Britain, 459.
slaughtering, cutting, and curing, Utah, 549.
tissues, microscopic study, 549.
(See also Cattle, beef.)

Beekeepers' Association of Ontario, report, 159.

Beekeeping—

guide, 456.
in Canada, Can., 456.
in Palestine and Egypt, 251.

Bees—

carbohydrate metabolism in, 648.
dipterous enemy of, 250.
diseases and pests, control, 456.
foulbrood. (See Foulbrood.)
fungus diseases, U.S.D.A., 759.
moving at orchard blooming time, effects, 159.
physiology of senses, 241.
poisoning from sprayed cotton, Tex., 656.
pollen digestion, mechanics of, Wis., 58.
queen, artificial insemination, 159, 241, 650.
queen rearing, 547.
respiratory exchange, 159.
respiratory studies, Calif., 753.
role in plant pollination, 650.
tongue variability, 650.
winter protection, Mich., 457.
(See also Honey.)

Beet—

leaf bug, studies, 544.
leafhopper, Rickettsia-like microorganism in, Calif., 752.
mosaic, studies, 49.
seed germination, 136.
sugar industry in Colorado and in United States, 178.

Beets—

culture experiments, P.R., 737.
effect of mulching paper, N.Y.Cornell, 737.

field or fodder. (See Mangels.)

strain tests, Ill., 337.

sugar. (See Sugar beets.)

testing sugar content, 133.

variety tests, Tex., 637.

Belascaris marginata, notes, 265.

Bemisia gossypiperda n.sp., notes, 452.

Berries. (See Fruits, small, and Raspberries. Strawberries, etc.)

Berseem stem rot, notes, 535.

Betulaceae, cytological studies, 510.

Bibliography of—

abortion, 263; Del., 409.

abortion spread, relation of bull to, 263.

alligators, U.S.D.A., 751.

Anchylopera angulifasciana, N.Y.Cornell, 453.

anemia treatment by blood transfusion, 467.

Anopheles larvae, ecology, 450.

Anopheles maculipennis spread, 249.

apple sucker, 56.

bees, fungus diseases, U.S.D.A., 759.

beet leaf bug, 544.

birds, migration, 850.

birds of Colorado, 447.

blood regeneration, 596.

brown-tail moth imported parasites, U.S.D.A., 356.

carrot psyllid, 854.

Cicadidae of Kansas, 245.

climate of Mexico, U.S.D.A., 611.

clothing, hygienic aspects, U.S.D.A., 695.

cod-liver oil in animal feeding, 693.

combining, S.Dak., 780.

Coreidae of Kansas, 245.

corn borer, European, U.S.D.A., 248.

corn borer, European, parasite, 860.

corn rootworm, southern, Ala., 759.

cotton culture, 280.

Diptera of Porto Rico and Virgin Islands, 546.

emulsions, 801.

Encyrtinae of Japan, 861.

engineering, climatic cycles in, U.S.D.A., 504.

ergosterol, irradiated, 590.

field experiments, 518.

flour, whole wheat, value, 583.

fowl pox control, 472.

fur farming, 462.

germination of seed, 834.

gipsy moth imported parasites, U.S.D.A., 356.

grasshoppers, effect of temperature and moisture, Mont., 756.

Haemonchus contortus, 378.

hay, spontaneous combustion, 177.

insects relation to weather and climate, 613.

Bibliography of—Continued.

- iodine, use in veterinary practice, 770.
 Lepidoptera, female reproductive organs, 450.
 livestock insurance, 183.
 malaria carrying mosquitoes, 545.
 marketing, 284.
 nutrition, 687.
Olethreutes cespitana, N.Y.Cornell, 453.
 onion root maggot, 242.
Panolis flammea, 545.
 parasitology, 167.
 plant diseases, 450.
 potato flea beetle injury, 456.
 Protocalliphora larvae affecting nestling birds, 455.
Pinus hololeucus, 250.
 rabies, 564.
 rice, irrigation water depth, 474.
 Rickettsia diseases in Tropics and filtrable virus, 467.
 rusts, 48.
 sewage disposal for isolated homes, 385.
 sleepy grass poisonous to livestock, U.S.D.A., 75.
 spider beetle, 859.
 quill powders as raticides, U.S.D.A., 447.
 Strongyloides in swine, 670.
 sweetpotato sawfly, Va.Truck, 859.
 tropisms, 539.
 vitamin A distribution in corn-milling products, 492.
 vitamin B complex, 493.
 window material for ultra-violet radiation, 480.
 wireworms, 450.
 wireworms, parasites of, 456.
 zoology of Malay Archipelago, 539.
 Bichloride of mercury. (See Corrosive sublimate and Mercuric chloride.)
 Big liver disease of fowls, Pa., 380.
Bikukulla eximia, botanical and chemical study, 376.
 Bile of foot-and-mouth disease affected animals, infectivity, 168.
 Bindweed eradication, Wash.Col., 37.
 Biochemistry—
 outlines, 201.
 recent advances in, treatise, 309.
 Bioenergetics, laboratory of Scientific Society of the Hygiene of Nutrition, 598.
 Biological—
 material, aluminum in, determination, 503.
 stains, handbook, 311.
 Biology—
 principles, discussion, 213.
 principles, treatise, 446.
 systematic, and mutation theory, 821.
 Biotite in soil, alteration, U.S.D.A., 120.
 Birch leaf mining sawfly, notes, 158.
- Bird—
 banding, manual for, U.S.D.A., 447.
 mortality, causes, 240.
 pests of Colorado, control, 539.
- Birds—
 aquatic game, propagation, U.S.D.A., 646.
 blood, leucocyte content, 564.
 damaging greens, prevention, 539.
 game, for naturalizing in United States, U.S.D.A., 447.
 migration, manipulation of reproductive cycle, 850.
 nestling, injury from Protocalliphora larvae, 455.
 of Australasian South Polar quadrant, 447.
 of Australia, 447.
 of Colorado, guide, 447.
 of North and South America, catalogue, 850.
 paper wasps as enemies, 547.
 protection, directory of officials for, U.S.D.A., 52.
 reproduction in, physiology, 515, 825.
 summer, of Adirondacks, 850.
 treatise, 447.
 upland game, propagation, U.S.D.A., 646.
- Bismuth fastness of rat bite fever spirochete, 167.
- Biston strataria in forests of Voronezh, 242.
- Blabera fusca, life history, 450.
- Black disease—
 bacilli in sheep livers, 568.
 etiology, 167.
 in New South Wales, cause, 467.
 of sheep in Victoria, 669.
- Black scale, notes, 542.
- Blackberries—
 breeding, 139.
 variety tests, Tex., 636.
- Blackberry anthracnose, control, Ill., 347.
- Blackhead in turkeys—
 account, 776.
 cecal ablation for, Mo., 74.
- Blackleg—
 atypical form, 467.
 in calves, etiology, 558.
 in Nigeria, 264.
 in sheep, cause, 773.
 transmission by Tabanidae, 168.
- Blastinus spp., notes, Tex., 652.
- Blastophagus minor regularity in propagation, 243.
- Blood—
 analysis, methods, Pa., 313.
 composition on exclusive meat diet, 491.
 filtrates, preparation, 408.
 in hog cholera, examination, 773.
 of cattle and sheep, quantitative examinations, 667.
 of cattle, composition, 864.

Blood—Continued.

- of chickens, physiology, 260.
- of domestic animals, 260.
- of fowls, white cells in, counting, 170.
- picture and clinical significance, treatise, 667.
- regeneration, 596.
- regeneration in nutritional anemia, effect of inorganic elements, 695.
- serum of chicks, effect of rachitic diets, 551.
- studies, 667.
- studies with milking animals, N.Y. Cornell, 766.
- sugar of cow in milk fever, 264.
- transfusions in treatment of anemias, 467.

Blueberries—

- northern, adaptability, Miss., 38.
- propagation, Miss., 38, 137.

Blueberry farms, economic study, Me., 677.

Boars, breeding, inheritance of mating ability in, 823.

Boll rots, notes, 145.

Boll weevil—

- biology at Florence, S. C., U.S.D.A., 358.
- control, Ga.Coastal Plain, 757.
- infestation, relation to location of cotton fields in previous season, 655.
- ingestion of poison by, Fla., 354; Tex., 651.
- Mexican, biology, 456.
- Mexican, control program, 647.
- movement, study, S.C., 651.
- poisoning, survey, S.C., 651.
- studies, S.C., 650.
- thermotropism of, 250.

Bollworm—

- in tomato, control, S.C., 651.
- notes, Tex., 652.
- on cotton, uneven distribution, 655.
- pink, in Gezira district of Sudan, 453.
- pink, papers on, 647, 648.
- pink, studies, Tex., 652.

Bombyx mori. (See Silkworms.)

Bone—

- chewing and carrion poisoning, 467.
- composition, effect of massive doses of irradiated ergosterol, 296.
- meal, fertilizing value, 417.
- meal for laying hens, S.C., 661.

Bones, calcification on rachitic and non-rachitic diets, 693.

Books on—

- agrarian revolution, Mexican, 283.
- agricultural economics, 187.
- agricultural education in United States, 390.
- agriculture for rural teachers, 457.
- animal breeding, 213.
- animals, vertebrate, of northeastern United States, 239.
- bacterial metabolism, 707.
- bacteriology, 166, 259, 667, 770, 821.

Books on—Continued.

- bacteriophagy, 875.
- beekeeping, 456.
- biochemistry, 201, 309.
- biological stains, 311.
- biology, principles, 446.
- birds, 447.
- birds of Australasian South Polar quadrant, 447.
- birds of Australia, 447.
- birds of Colorado, 447.
- blood microscopy, 667.
- chemistry, agricultural, 501.
- chemistry, organic and food, 487.
- chicks, early embryology, 164.
- chrysanthemums, 143.
- citrus insect control, 451.
- cold storage and refrigeration, 571.
- colloid chemistry, 501.
- cotton marketing, 285.
- culture media and reagents, 311.
- culture medium technic, bacteriological, 311.
- dairy farming, 869.
- diet in health and disease, 667.
- dietetics, 90.
- droughts and floods, British, 314.
- ecology, agricultural, 314.
- electrolytes, 310.
- enzymes, 309.
- farm machinery and equipment, 382.
- fats, inedible animal, in United States 711.
- floods and droughts, British, 314.
- food for the family, 666.
- food preservation, 686.
- foods, distribution in large cities, 579.
- forest insects, 451.
- forest reserves, vanishing, 843.
- forests and mankind, 843.
- fruit growing, 228, 638.
- fur farming, 462.
- gardening, 228.
- gardening in southern California, 842.
- goats, 459.
- grapes, culture, 140.
- H-ions, determination and importance in chemistry, 707.
- home living problems, 487.
- insects of Norway, 242.
- insects, ticks, mites, and venomous animals of medical importance, 542.
- iodine, use in veterinary practice, 770.
- life and reproduction, 515.
- livestock feeding, 160.
- mammals, anatomy and classification, 446.
- mankind and forests, 843.
- marketing, 284.
- marketing, cooperative, 187.
- meat trade, 658.
- microorganisms, 259.
- milk and milk products, 463.
- motor vehicles, 673.
- nutrition, 686, 687.
- parasites, animal, 355.

Books on—Continued.

- parasites, animal, of man and domestic animals, 240.
 parasites, external, 154.
 parasitology, 167.
 physiology, 770.
 physiology, chemical, essentials, 893.
 plant breeding, 827.
 plant diseases, 144.
 plants, perennial, 842.
 post-mortem diagnosis, 166.
 poultry, 869; Miss., 163.
 protoplasm, colloid chemistry, 309.
 protozoa, intestinal, in man, 448.
 protozoology, 447.
 rabbit hutch, 164.
 rayon industry, 598.
 reagents and culture media, 311.
 refrigeration, cold storage, and ice making, 571.
 reproduction and life, 315.
 roses, culture, 438, 639.
 rural sociology, 183, 891.
 rusts, 47.
 salts, acids, and bases, 310.
 science, application to crop production, 701, 796.
 sheep production, 162, 187.
 silicates, soluble, in industry, 707.
 social research, 184, 580.
 sociology, rural, 183, 891.
 sociology, rural-urban, 286.
 soil technology, principles, 810.
 soils, nature and properties, 810.
 stereochemistry, 310.
 sweet peas, 143, 843.
 tractors, 673.
 tularemia, 263.
 tulips, 143.
 vegetables, production, 838.
 veterinary medicine, 260.
 wood, 343.
 zoology, 213, 538.
- Boophilus**—
annulatus calcaratus, vector of *Franciella colchica*, 469.
australis, nymphal, resistance to arsenical dips, 263.
- Bordeaux mixture, preparation, Mo., 40.
 Borna disease, summary, 875.
- Boron**—
 deficiency, effect on plants, 619.
 effect on citrus trees, 819.
 effect on plants and animals, Ky., 203.
 requirements of citrus trees, 142; Calif., 744.
 toxicity, Calif., 744.
- Bosicola tricoilaris* n.g. and n.sp., description, 850.
- Botulism**—
 due to home-canned pears, 597.
 in horses and grass disease, comparison, 774.
 outbreak from home-canned beets, 596.
 summary, 875.
 toxoids, production, Ill., 375.

Boys—

- births, fluctuation in monthly ratio, 827.
 of private day school, growth, 188.
 play suits for winter, U.S.D.A., 598.
 small, suits for, U.S.D.A., 298.
- Brachymeria flivensis* n.sp., notes, 861.
- Brassicas, germination, 136.
- Braula cocca*, enemy of honeybee, 250.
- Bread**—
 loaf crust color, relation to diastatic power of flour, 288.
 white, feeding value to animals, 559.
 whole wheat and white, controversy, 90, 787, 788.
 (See also Flour.)
- Breakpins, wooden, substitutes for, Calif., 477.
- Breeding. (See Animal breeding, Plant breeding, and specific animals and plants.)
- Broccoli, culture, 836.
- Bronchitis, infectious, of fowls, 772; Ill., 380; West.Wash., 557.
- Broom sedge composition at successive stages, 131.
- Broomcorn—
 culture under dry land conditions, N.Mex., 32.
 outlook for 1930, Okla., 784.
 variety tests, Tex., 626.
- Brown-tail moth, imported insect enemies, U.S.D.A., 356.
- Brucella abortus**—
 agglutinins from human sera, 772.
 agglutinins from porcine blood, 773.
 immunity in rabbits, 262.
 in man, experimental infection, 608.
 in pigs, transmission, Mo., 73.
 infection in cow's udder, diagnosis, 559.
 protein extract for treatment of undulant fever, 169.
 rôle in human infections, 261.
 strains, absorption of agglutinins by "R" variants, 262.
 (See also *Bacterium abortus*, *Alcaligenes abortus* and Abortion.)
- Brucella melitensis**—
 notes, Ky., 262.
 skin as portal of entry, 559.
- Brucella species**—
 differentiation, Mich., 75.
 pathogenicity for monkeys, 559.
- Brussels sprouts mosaic, degree of susceptibility, 847.
- Buckwheat**—
 development and growth, effect of pH, 318.
 enemies of, 243.
- Bud moth, eye-spotted, as apple pest, 249.
- Bud moths in Nova Scotia, habits and life histories, 454.
- Budgerigars, hybrids, 620.
- Buffalo fly menace in Australia, 167, 858.
- Building materials, effect of moisture changes, 672.

Buildings, frame, sheathing, nailing, bracing for, 672.

Bulb mite, bionomics, 360.

Bulls. (See Sires.)

Bunostomum trigonocephalum, control, 877.

Bunt. (See Wheat smut, stinking.)

Bupalus piniarius poisoning, 450.

Burbot-liver oil, antirachitic factor in, 95.

Bureau of—

Agricultural Economics, available information for extension, 89.

Agricultural Economics, research projects in, U.S.D.A., 82.

Entomology publications of personnel of Cereal and Forage Insect Investigations, U.S.D.A., 450.

Plant Industry, field activities, directory, U.S.D.A., 599.

Bursa Fabrici growth in birds, 515.

Butter—

digestion rate, N.Y.Cornell, 788.

effect of feeding soybeans, S.C., 665.

effect on whipping properties of ice cream, 465.

flavor, effect of various starter cultures, Ark., 873.

industry of Oregon, Oreg., 873.

keeping quality, Vt., 259.

keeping quality, index of, 464.

keeping quality, relation to cream acidity, U.S.D.A., 258.

making, studies, Ark., 872.

oil, keeping quality, Vt., 259.

oil utilization by rats and dogs, 291.

vitamin A in, 111.

Butterfat—

in condensed and evaporated milk, test for, Pa., 373.

in ice cream, Babcock and Mojonnier tests, 808.

percentage, effect of oestrus, 871.

yield of cheese per pound, 556.

Butterflies of British Honduras, 452.

Buttermilk, dried, value for egg production, Mo., 67.

Butyric acid determination, 14.

Cabbage—

clubroot, control, 535.

culture experiments, P.R., 737.

effect of mulching paper, N.Y.Cornell, 737.

fertilizer experiments, Ill., 337; Miss., 138; N.Y.State, 431; Ohio, 41.

genetical studies, Del., 735.

leaves, green and white, vitamin A in, 206.

maggot, control, N.Y.State, 449.

mosaic, degree of susceptibility, 847.

premature seedling, factors affecting, N.Y.Cornell, 25.

seed, treatment, Miss., 145.

self-sterility in, Calif., 724.

strains, Pa., 339.

varieties, N.Dak., 138; S.C., 636.

variety tests, Tex., 637; U.S.D.A., 40.

Cabbage—Continued.

wintered-over, premature flower formation, Md., 340.

yellows resistant varieties, Mo., 39.

Cacao—

cured, causes of moldiness, 149.

Trinidad and Java, 528.

Cacti, culture and uses, U.S.D.A., 231.

Cadophora fastigiata n.g. and n.sp., notes, 538.

Calamondin stock for citrus, Tex., 637.

Calcium—

and magnesium, absorbed and exchangeable, in soils, 818.

and phosphorus ratio in growth of chicks, 461.

assimilation, effect of ingestion of magnesium salts, 458.

availability and base exchange in rice soil, Ark., 811.

balance in plant metabolism, 618.

compounds, effect on soil and plant growth, 122.

cyanide as insecticide in France, 647.

cyanide, evolution of hydrocyanic acid from, 448.

cyanide for greenhouse pests, 449.

deficiency, effect on apple trees, 639.

effect on nodulation of legumes, 226, 518.

effect on nodulation of soybeans, 226.

in alfalfa plants on different soil types, 220.

in blood, effect of excessive doses of irradiated ergosterol, 197.

in feces, relation to pH, 198.

in hays of Quebec, 549.

in milk, mechanism of secretion, 871.

in pea plants, variations, 415.

metabolism during menstrual cycle, 290.

metabolism of dairy cattle, 870.

metabolism of laying hens, Ky., 68.

phosphate, solubility in fresh milk, 556.

requirements of sows, Mo., 64.

requirements of tobacco, 721.

salts, ingestion, results, 790.

serum, effects of protein and phosphorus, 789.

sources for chicks, Ky., 256.

utilization by growing chicks, 766.

(See also Lime.)

Calendra—

granaria. (See Granary weevil.)

oryza. (See Rice weevil.)

California—

Station, notes, 300, 697, 900.

Station, report, 795.

University, notes, 300, 697, 900.

Calomel electrode, saturated, investigation, 11.

Calopogonium mucunoides—

curly disease, notes, 47.

insect pests, 450.

Calosoma beetles, trapping, 158.

Calosoma calidum, notes, 856.

Calotermes in living plants, control, 853.

Calves—

dairy, feeding and management, Calif., 371.

dairy, on diet of concentrates, Calif., 768.

dairy, raising, Iowa, 462.

fattening, feedlot rations, Colo., 253.

feeding and finishing, Mo., 61.

feeding method on dry feed, 554.

healthy, raising, 554.

high- and low-grade, relative value, W. Va., 658.

Holstein, length of time receiving milk, Ohio, 371.

milk substitutes for, Mass., 257.

nutrition, rôle of vitamin C in, 554.

veal, feed cost and returns, Ohio, 336.

weight studies, Miss., 164.

Camels, trypanosomiasis in, mercuric chloride test for, 77.

Camnula pellucida, effect of temperature and moisture, Mont., 755.

Camponotus herculeanus, biology, 449.

Campomeris—

radula, economic value, 546.

tasmaniensis, economic value, 546.

Canadian Phytopathological Society, organization, 789.

Canary birds, genetics of, 514.

Cancer, skin, in cattle, 167.

Cane borer parasites from Cuba, liberation, Fla., 352.

Canned—

corn, causes of blackening, Ill., 337.

foods, report, 772.

foods, vitamins in, 93, 396.

Cantaloupe. (See Muskmelon.)

Cape weed, feeding experiments, 467.

Capsid bugs on fruit trees and bushes, 57.

Coradunia myersi n.g. and n.sp., description, 360.

Carbohydrate—

foods, new analyses, 496.

low diet, 91.

metabolism, effect of vitamin deficiencies, 896.

tolerance of two men, effect of exclusive meat diet, 491.

Carbohydrates—

in plant foods, 488.

production in plants, effect of potassium, 819.

Carbon—

deposits from lubricating oils, 570, 571.

dioxide evolved from soils, determination, 408.

dioxide in respiration of apples, apparatus for determination, 615.

dioxide use to increase insecticidal efficacy of fumigants, 152.

disulfide for Japanese beetle, 157.

in soil, relation to green manure, 816.

in soils, total, determination, 408.

Carbon—Continued.

tetrachloride, anthelmintic value, 566, 877.

tetrachloride in dogs, absorption, distribution, and excretion, 470.

Carcass studies of steers and heifers, Mo., 61.

Carnations, soil studies, Ill., 338.

Carotin—

and vitamin A, 587.

in green leaves, extraction and separation, 616.

relation to vitamin A, 492.

Carotinoids, biochemistry, 112.

Carpet grass germination, 130.

Carpocapsa pomonella. (See Codling moth.)

Carpophilus hemipterus in stored food products, 243.

Carrot—

psyllid, biology and distribution in Sweden, 855, 854.

rust fly in Massachusetts, 250.

rust fly, studies, N.Y.State, 449.

Carrots—

culture experiments, P.R., 737.

varieties, N.Y.State, 431; S.C., 636.

variety tests, N.Dak., 129; Tex., 637.

Caslein—

chemistry of, N.Y.State, 407.

molecular weight, 606.

Cassava grater, description, 478.

Castnia leucis, studies, 854.

Casiniomera humboldti on bananas, 854.

Castration effects, prevention by testis extract injection, 824.

Cat trap, construction, U.S.D.A., 447.

Cutolaccus hunteri, parasite of boll weevil, U.S.D.A., 359.

Cattle—

abdominal organs in, topography, 166.

beef, carcasses relation to sex and age, Mo., 60.

beef, feeding and breeding experiments, Can., 549.

beef, feeding experiments, Ill., 361; Kans., 362; Miss., 60, 161.

(See also Calves and Steers.)

beef, outlook for 1930, Okla., 784.

beef, production, Miss., 161.

beef, wintering, Mont., 253.

beef, wintering, effect and economy of shelter, Miss., 161.

bloat on sweetclover pastures, Mont., 260.

body weight, insensible loss in, 863.

breeding herd, management, Miss., 161.

crossbred herd, hereditary data, Ill., 323.

dairy—

and dairy products, foreign trade in, U.S.D.A., 388.

cost of raising, W.Va., 678.

daily fluctuations in weight causes, N.Y.Cornell, 768.

feeding and breeding experiments, Can., 549.

Cattle—Continued.

dairy—continued.

feeding experiments, Ark., 869;
Miss., 164; Mont., 257; Tex.,
663.

growth, Mo., 70.

improvement, heredoscope demon-
stration, 823.

mineral feeding experiments,
Mich., 870.

official testing, simplification, 463.
(See also Cows.)

diseases, conference on, 264.

(See also specific diseases.)

double loin character, inheritance, 824.

energy metabolism relation to plane
of nutrition, 656.

feed consumption, relation to other
factors, 862.

feeding experiments, Alaska, 160.

(See also Cattle, beef, Cattle,
dairy, Calves, and Steers.)

feeding practice, Ill., 361.

foreign trade in, U.S.D.A., 579.

heavy feeding v. light feeding, Ill.,
362.

Holstein, Jersey, and Ayrshire, prog-
eny performance, Md., 70.

in tick-free areas of South, improve-
ment, U.S.D.A., 254.

mineral metabolism, studies, 863, 870.

new strongyloid parasite of, 850.

on phosphorus-deficient pasture, breed-
ing, 863.

plague. (See Rinderpest.)

poisoning. (See Livestock poisoning,
Plants, poisonous, and specific
plants.)

production in range country, U.S.D.A.,
160.

salt sickness, control, Fla., 374.

sterility in, treatment, 562.

ticks, eradication, 360.

(See also Ticks.)

variations in, 421.

(See also Calves, Cows, Livestock, and
Steers.)

Cauliflower—

black-rot or blight disease, studies,
N.Y.State, 748.

culture, 836; P.R., 737.

mosaic, degree of susceptibility, 847.

seed, hot water treatment, N.Y.State,
439.

Cedar, culture, Tex., 641.

Cedar, durability, Calif., 742.

Celery—

blight, prevention, 147.

Bordeaux mixture on, avoidance of
spray residue, 145.

culture experiments, P.R., 737.

premature seeding, Mont., 227; N.Y.
Cornell, 42.

red, varieties, N.Y.State, 431.

seed germination, 135, 136.

self-fertile varieties, Calif., 724.

turnip rooted, studies, 524.

Celery—Continued.

varieties, early, Ohio, 42.

water requirements, Can., 638.

Cell—

division at which crossing-over takes
place, 511.

sap of *Pinus ponderosa*, osmotic pres-
sure and pH, 419.

(See also Plant cells.)

Cel-O-Glass—

durability, 462.

seed bed sash for tobacco, Conn.State,
834.

Cement mortar, Portland, action of sul-
fates on, 568.

Cephalosporium acremonium, notes, Ill.,
346.

Cephenomyia sp., killing deer, 157.

Cephus cinctus. (See Sawfly, western
grass-stem.)

Ceratitis capitata. (See Fruit fly, Medi-
terranean.)

Ceratophyllus fasciatus. (See rat flea.)

Ceratostomella spp., notes, 538.

Cereal—

breakfast foods, nutritive value, 891.
diseases, studies, 534.

(See also specific hosts.)

rusts, loss from, 147.

(See also Rusts and specific hosts.)

seeds, certification in Germany, 220.

seeds on tubers of potato, seeding and
growth, 821.

smut, control, 534.

smuts, physiologic specialization in,
643.

Cereals—

antirachitic activation of, 898.

culture experiments, 130.

growing and stored, insects affecting,
852.

polyploidy in, 511.

production tests, Alaska, 127.

transplanting, technic, 220.

vitamins in, Ill., 390.

winter, meteorological conditions of
growth, 712.

(See also Grain and specific grains.)

Cerotoma trifurcata. (See Bean leaf
beetle.)

Cestodes of fowls, comparative investiga-
tions, 548.

Chalaenius australis, economic value, 546.

Chalcids, European, keys, 650.

Changa. (See Mole cricket.)

Chara sp., notes, Ark., 845.

Chara spp., relation to mosquito breeding,
249.

Chard, culture experiments, P.R., 737.

Chauliognathus marginatus, notes, Del.,
754.

Chauliops bisontula, notes, 450.

Cheese—

Canadian, potassium nitrate in, 873.

cottage, preparation and marketing,
555.

Cheese—Continued.

- Edam, effect of pasteurizing temperature of milk, 166.
- investigations, N.Y.State, 464.
- making in New Zealand, milk for, 356.
- process, color defect, 556.
- Swiss, texture, relation to pH, 464.
- yield per pound of butterfat, 556.

Chemistry—

- agricultural, studies, Calif., 716.
- agricultural, textbook, 301.
- colloid. (*See* Colloid chemistry.)
- organic and food, textbook, 487.

Chemotropism, ovipositional, experiments on, 653.

Chenopodium oil, anthelmintic value, 877.

Cherries—

- acidity and sugar in, Vt., 339.
- breeding, N.Y.State, 431.
- culture experiments, Alaska, 137.
- dropping of fruits and buds, Del., 749.
- grafting studies, Vt., 339.
- immature, dropping, causes, 435.
- notes, Ill., 335.
- pollination studies, 434; Can., 638; N.Y.State, 738.
- propagation studies, N.Y.State, 431.
- seedling stocks, N.Y.State, 432.
- sour, effect of pruning and fertilizing, Ill., 336.
- varieties in West Virginia, W.Va., 228.

Cherry—

- diseases and insects, control, N.Y.Cornell, 740.
- leaf shot hole, notes, 238.
- leaf spot, studies, N.Y.State, 439; Ohio, 351.
- maggot, control, N.Y.State, 449.
- orchards, spraying against leaf scorch, 537.
- trees on mahaleb roots, disease resistance, Calif., 745.

Chestnut curculios, studies, U.S.D.A., 250.

Chick—

- diseases, prevention, 471.
- embryos development, effect of lithium and magnesium salts, 460.
- embryos, early development, 827.
- embryos, heart beat of, 460.
- embryos, mortality, studies, Calif., 765.

Chicken—

- half and half skin-color mosaic in, 512.
- pox vaccine, preservative for, Calif., 771.

Chickens—

- blood of, physiology, 260.
- Elmeria species in, 267.
- feeding, all-mash method, 461.
- metabolism in, Ky., 255.
- mineral mixtures for, value, Ill., 367.
- sex ratio in, 423.
- (*See also* Chicks, Fowls, Hens, Poultry, and Pullets.)

Chickpea scorch, preventive methods, 147.

Chicks—

- blood serum, effect of rachitic diets, 551.

Chicks—Continued.

- brooding, air and temperature conditions required, Calif., 777.
- brooding and feeding, 552.
- calcium utilization by, 766.
- cost and growth to ten weeks of age, Miss., 67.
- down-color variations, inheritance of, 421.
- early embryology, treatise, 164.
- effect of night feeding under artificial illumination, 662.
- feather growth rate, 624.
- feathering rate, Ky., 256.
- feeding and management, Wash.Col. and West.Wash., 766.
- feeding experiments, Tex., 661.
- infection with intestinal protozoa, 776.
- livability inheritance, Pa., 368.
- new rations for, Mo., 67.
- nutrition, calcium-phosphorus ratio in, 461.
- produced by hens and by pullets, weights, Mo., 68.
- protein requirements, Calif., 764.
- protein sources for, 551.
- rearing in confinement, Del., 765; Ill., 868.
- weights of internal organs, relation to rations, Mo., 461.
- White Leghorn, early growth, 552.

Chicory, chemical composition, 330.

Child care and training, progress of work in, 89.

Children—

- basal metabolic rate and surface area, 687.
- mentally defective, relation to order of birth, 625.
- negro, weight, height, and age, relations, 792.
- of abnormal body weight, basal metabolism, 188, 189.
- of native white stock, physical measurements, 92.
- of pre-school age, nutritive condition and food habits, S.C., 289.
- school, growth relation to milk consumption, 289.
- school, milk feeding in Scotland, 893.
- school, nutrition, Fla., 392.
- school, ultra-violet irradiation of, 593.
- undernourished, studies, 490, 893.
- underweight measurement, precision and reliability, 491.
- young, diet, 587.
- young, physical traits, 490.
- (*See also* Boys, Girls, and Infants.)

Chlo simplex attraction to lights, 156.*Chimabache jagella*, biology, 450.*Chionaspis bambusae*, parasites attacking, 252.

Chipmunks, American, revision, U.S.D.A., 646.

Chlorates, weed control with, Ohio, 634.

Chlorine in tobacco. Ky., 218.

Chlorophyll—

- determination, quantitative, 616.
- in evergreens, periodical variations, 24.
- in green leaves, extraction and separation, 616.

Chloropicrin use against coccids of orange and date, 155.

Chlorosis—

- in rice, cause, Ark., 844.
- in Utah, treatment, 849.
- infectious in plants, 146.

Cholesterol—

- absorption spectra studies, 805.
- heat of combustion, 693.
- in blood of cow in milk fever, 264.
- provitamin D activity, 805.

Cholesteryl esters in Burgundy snail, antirachitic action, 594.

Chromocryptus mesorufus n.sp., notes, 860.

Chromosome—

- fragmentation in tomato, 724.
- pairing, absence of, heterotypic phases in, 511.
- translocations produced by X-rays in *Drosophila*, 124.
- X, locus of four factors in, 822.
- Y, in *Drosophila*, aberrations, 822.

Chromosomes—

- behavior in *Triticum* hybrids, 621.
- determination of heredity and sex by, 821.
- in males, selective segregation, 512.
- in pigeon hybrids, 123.
- in *Sciara*, sex, genetic identification, 512.
- number and mutation rate under X-ray treatment, 510.
- number in apples, 321.
- number in *Scirpus palustris*, 322.
- translocation in *Drosophila*, proof, 422.
- translocations induced by X-rays, 214.

Chrysanthemum caterpillar pest, life history notes, 545.

Chrysanthemums—

- culture in greenhouse, Ohio, 143.
- treatise, 143.

Chrysomphalus—

- dictyospermi*, parasites attacking, 252.
- ficus*. (See Red scale, Florida.)

Chrysopa Chrysopa, studies, 649.

Chrysopa flaviventris, anthrax transmission experiments, 168.

Church, rural. (See Rural.)

Cicadidae—

- geraniol bait as attractant, 653.
- of Kansas, Mology, 245.

Cicadulinea spp., notes, 237.

Ciders, sulfurous acid in, determination, 206.

Cimex lectularius. (See Bedbugs.)

Cinnabar moth for control of ragwort, 247.

Cirphis unipuncta in Russia, 542.

Cirrhosis of liver in horses, 876.

Oitellus tridecemlineatus, hibernation, 151.

Citrate, phylogenetic relations, 436.

Citric acid—

- decomposition by soil, 818.
- production by *Aspergillus niger*, 24.

Citrus—

- aphid, food plants of, 246.
- aphid infection by *Empusa fresenii*, Fla., 345.
- aphid, notes, Fla., 351.
- black fly, notes, 542.
- blight, notes, Fla., 344.
- canker control, Fla., 344.
- canker organism, invasion of fruit tissues by, 51.
- culture in Japan, 436.
- frost injury, Tex., 636.
- fruit shipments, distribution, Fla., 388.
- fruits and wild relatives, phylogenetic relations, 436.
- fruits grown in the Orient, 436.
- (See also Lemons, Oranges, etc.)
- fumigation, developments in, 647.
- fumigation, new material for, 448.
- fumigation work, Fla., 351.
- growth, effect of boron, 142.
- insects, control, 448, 647, 653.
- insects, control, handbook, 451.
- leaf structure, studies, Calif., 734.
- mealybug, biological control, 450.
- mottle leaf production, Calif., 744.
- pests, control in Louisiana, 355.
- pests, entomophagous insects for control, 647.
- pollination, 436.
- products industry, 9.
- propagation by cuttings, 529.
- psorosis, notes, Fla., 344.
- rootstock, determining species, P.R., 788.
- scale insects of China, 650.
- scion and stock, chemical relations, Calif., 734.
- stocks, studies, Fla., 335.
- transpiration studies, Calif., 745.
- trees, effect of boron, 819.
- trees, effects of desiccating winds, Calif., 722.
- trees, fertilizer experiments, Calif., 733.
- trees, oil sprays for, studies, Calif., 751.
- trees, reduction of thorniness, Calif., 723.
- trees, root-grafting, 436.
- white fly. (See White fly, citrus.)
- Clasterosporium carpophilum*, notes, 238.
- Clasoptera* sp., parasite of, 360.
- Clay, plastic, wearing action on cast iron and carbon-chrome steel, 568.
- Clay soils, friction and cohesion, U.S.D.A., 567.
- Climate—
 - and agriculture in Russia, 712.
 - and epidemic diseases, 648.
 - and vegetation, contemporary changes in, 712.
 - and weather, relation to insects, 850.
 - control by man, 313.

Climate—Continued.

of Indo-China and agricultural meteorology, 409.

of Mexico, U.S.D.A., 611.

of Ohio, Ohio, 610.

(See also Meteorology.)

Climatological data. (See Meteorological observations.)

Clinodiplosis pisicola n.sp., notes 357.

Chiocybe tabescens, notes, Fla., 344.

Clostridium—

botulinum, toxicity of sodium benzoate to, Calif., 787.

(See also *Bacillus botulinus*.)

chauvei, notes, 558.

hemolyticus dovis, notes, 261, 264.

oedematoides and *Bacillus sordellii*, comparison, 261.

oedematoides immunity maternally transmitted, 667.

oedematoides n.sp., description, 261.

parabotulinum type A, notes, 597.

Clothes moths, repellents against, 156.

Clothing—

and textiles, Government publications, selected list, U.S.D.A., 735.

class, ninth-grade, individual assignment in, 488.

relation to health, bibliography. U.S.D.A., 695.

Clover—

alsike and timothy mixtures, analyzing and labeling, 136.

alsike, in combinations for hay, West. Wash., 518.

crimson, as cover crop, S.C., 33.

crimson, tests, 136.

culture experiments, Ky., 218; P.R., 731.

Day, program, Ohio, 90.

Egyptian. (See Berseem.)

fertilizer experiments, Ark., 828.

hays of Quebec, calcium and phosphorus in, 549.

leaf caterpillar, studies, N.Y.Cornell, 452.

leaf tyer, studies, N.Y.Cornell, 452.

red, breeding, N.Y.Cornell, 731.

red, seed setting, factors affecting, 26.

red, seed studies, Ill., 330.

red, variety tests, Del., 728; Ill., 328.

seed midge, life history and bionomics, N.Y.Cornell, 57.

seed, red, cracked and broken, behavior, 136.

Subterranean, seed impurities, 426.

Subterranean, winterkilling, 426.

sweet. (See Sweetclover.)

weevil on Subterranean clover, 158.

white, culture experiments, Ky., 218.

Oxyia ambigua in German vineyards, 648.

Oxytus lama, notes, 450.

Coccidae—

of Formosa, 452.

of North Africa, 544.

parasites of, 252.

Coccidiosis—

account, West.Wash., 557.

cause of rickets, 172.

in gallinaceous birds, 266.

in poultry, Fla., 374.

in rabbits, creolin therapy, 381.

in sparrows and poultry, 267.

renal, of geese, 267.

therapy, 380.

Coccidium truncatum n.sp., notes, 267.

Coccinellidae, origin of geographical varieties, 648.

Coccophagus gurneyi, parasite of citrophilus mealybug, Calif., 751.

Coccus viridis, notes, 542.

Cochlosomidae, new family, erection, 671.

Cockchafer beetles, economic value, 546.

Cockchafers of Odessa, geographical distribution, 242.

Cockroach, giant, life history, 450.

Coconut—

caterpillar, parasite of, life history and habits, 455, 457.

meal, feeding value, Ohio, 696.

oil utilization by rats and dogs, 291.

palm, dwarf, in Malaya, 142.

palms, culture, botany, and use, 231.

palms, fertilizer experiments, P.R., 738.

Coding moth—

artificial light experiment, 547, 757; Calif., 751.

as pest of stone fruits, 156.

bait trap studies, 247.

bionomics and control, Del., 753.

control, 453, 545; Ill., 352; Pa., 354.

control, banding for, 247.

control in South Africa, 648.

control, spraying costs, 854.

control, value of bait trap, Calif., 752.

eggs, parasitism, 647.

emergence, timing spray schedule by, Mo., 54.

in North America, papers on, 648.

larvae, Missouri and Colorado, lethal dosage of arsenic for, 247.

larvae, newly hatched, lethal dose of arsenic, 241.

life history and control in New South Wales, 854.

life history and habits, 453, 541.

paper on, 540.

parasites, notes, Del., 754.

studies, 248, 852; Mo., 54.

trap baits, insects captured in, 654.

Cod-liver oil—

antimony trichloride reaction for vitamin A in, 112.

digestion rate, N.Y.Cornell, 788.

effect on egg production, Mo., 67.

effect on egg production and fertility, Ark., 868.

effect on wool yield of Angora rabbits, 462.

for laying hens, S.C., 661.

in animal feeding, bibliography, 698.

utilization by rats and dogs, 291.

Cod-liver oil—Continued.

- v. irradiated milk as source of vitamin D, 692.
- vitamin D in, effect of storage, N.Y. Cornell, 759, 766.

Coffee—

- experiments, 138.
- fertilizer experiments, P.R., 737.
- insects, notes, 451.
- Philippine, composition, 584.
- trees, borers in, control, P.R., 737.

Coffees of the world, 529.

Colaspis—

- brunnea*. (See Grape colaspis.)
- hypochlora*, studies, 358.

Cold storage and refrigeration, treatise, 571.

Collecting trip to Patagonia and Chile, 648.

College—

- curriculum, three-in-one, 88.
- student elimination, causes and implications, 88.

Colleges. (See Agricultural colleges.)

Colletotrichum circinans, notes, 237.

Colloid chemistry—

- of protoplasm, 309.
- principles and applications, treatise, 801.

Colloidal—

- behavior of soils, laws, 410.
- material in Missouri soils, Mo., 17.
- properties of Willamette Valley soils, 411.

Colonization in Palestine, dairy industry as basis, 890.

Color—

- changes in animals, seasonal, 514.
- inheritance in asters, 513.
- inheritance of down in chicks, 421.
- measurement of agricultural products, U.S.D.A., 503.
- patterns in grouse locust, inheritance, 422.

Coloradorea pandora, studies, U.S.D.A., 356.

Combines—

- effect on agronomic practices and research, 217.
- for harvesting corn, 272.
- in Minnesota, status and use, Minn., 477.
- in Wiltshire, England, tests, 175.
- operation and care, U.S.D.A., 383.
- tests, Ill., 382.
- use, S.Dak., 779.

Community—

- organization, papers on, 580.
- organization, process of, Mo., 86.
- (See also Rural community.)

Concrete—

- action of sulfates on, 568.
- arch construction, Freyssinet method, U.S.D.A., 271.
- cylinders, strength, effect of methods of capping, Colo., 880.
- standard specification, 477.

Congenital loco in chicks, Oreg., 77.

Coniferous seedlings, tissue changes in, Calif., 742.

Conifers—

- reproduction, effect of high temperatures, 531.
- seed germination, hastening, 640, 844.
- sterilization of seed beds, 640.

Connecticut—

- State fifty years' index, 795.
- State Station, notes, 797.
- State Station, report, 599.

Consumption as field for research, economics of, 572.

Cooperation. (See Agricultural cooperation and Marketing.)

Cooperative—

- associations, farmers', in United States, U.S.D.A., 85.
- associations, papers on, 632.
- financing of production and physical facilities, 682.
- movement, policies, 681.
- oil associations in Minnesota, U.S. D.A., 579.
- purchasing associations, farmers' local, business practices, Pa., 86.

Copper—

- colorimetric determination, 807.
- effect on anemia of rice disease, 596.
- effect on plants and animals, Ky., 203.
- feeding to cows, effect on milk, Ill., 369.
- fungicides, supplements for, Mass., 47.
- in dairy products, solubility, 556.
- in eggs, effect of hens' diet, 789.
- in feeding stuffs, 457.
- in milk, effect of cow's diet, 463, 892.
- in normal nutrition, 585.
- in pasteurized milk, Calif., 769.
- in plant and animal foods, 190.
- in the organism, physiological aspects, 690.
- metabolism of rats, 689, 691.
- paste, colloidal, for control of fruit spot, Del., 746.
- specificity as supplement to iron for anemia, 688.
- storage in body, effect on hemoglobin building, 391.
- sulfate and tobacco infusion, anthelmintic value, 877.
- sulfate preparation and effectiveness as fungicide, Mass., 440.
- supplementing action for iron in regeneration of hemoglobin, 689.

Cordia spp., paper on, 647.

Coreidae of Kansas, 245.

Corn—

- and kafir in rotations, comparisons, Mo., 31.
- and soybeans, hogging down, Miss., 63.
- black-bundle disease, notes, Ill., 346.
- borer, European—
- bibliography, U.S.D.A., 248.
- control, effect of plowing equipment, Pa., 354.

Corn—Continued.

- borer, European—continued.
 - control machinery, tests, Ill., 381.
 - developments during 1929, Ill., 759.
 - in central Europe, U.S.D.A., 453.
 - in Europe, infestation and parasitism, 248.
 - in Ontario, papers on, 541.
 - in Philippines, 856.
 - menace from, Conn.State, 599.
 - natural control, 241.
 - notes, N.Y.State, 449.
 - papers on, 647.
 - parasite of, 860.
 - parasites in Canada, 541.
 - parasites, liberation, Ill., 352.
 - population, height and silking as factors, 856.
 - so-called, in Japan, 647.
- breeding, Ark., 828; Fla., 325; Ill., 327; Miss., 31, 128; Mo., 31; N.Y. Cornell, 731; Tex., 627.
- Canada Learning, characteristics, Conn. State, 731.
- canned, causes of blackening, Ill., 337.
- chlorosis, cause, 441.
- chops v. cane molasses for milk production in Porto Rico, 165.
- chops v. sagrain for dairy cows, Miss., 164.
- continuous selection for composition, effect, 34.
- culture experiments, Ark., 828; Fla., 325; Miss., 31; N.Dak., 120; S.C., 625; Tex., 627.
- culture under dry land conditions, N. Mex., 32.
- ear rots, control, Ill., 346.
- ear worm—
 - control, Calif., 753.
 - hibernation, Va., 757.
 - injury from, S.C., 651.
 - protecting sweet corn from, 248.
- effect of lime, S.C., 508.
- fertilizer experiments, Ark., 828; Fla., 325; Ga.Coastal Plain, 729; Miss., 31, 128; S.C., 625; U.S.D.A., 32; West.Wash., 508.
- germination, studies, 135, 136.
- growing and marketing, 513.
- hand-feeding v. free-choice feeding to hogs, S.C., 660.
- harvesting, low-cutting devices for, U.S.D.A., 78.
- harvesting with combine, 272.
- hogging off, S.C., 660.
- hybrids, variety tests, Ill., 327.
- improvement, studies, 420.
- inheritance studies, Tex., 627.
- interchanges between plant and culture solution, 319.
- kernels, distribution of vitamin G in, 194.
- kernels, effect of pericarp injury, 26.
- leaf aphid, notes, 153, 536.

Corn—Continued.

- meal, digestibility studies, balancing rations for, Va., 164.
- milling products, vitamin A distribution, 492.
- monthly prices and shipments, Iowa, 484.
- mosaic endosperm in, chromosome aberration, Mo., 31.
- planter fertilizer attachments, tests, 272.
- planting tests, Ill., 327; N.Dak., 129.
- plants, effect of injuries to leaves, 519.
- production with mechanical power, Ill., 382.
- production with mechanical power on alluvial lands, 175.
- root rot, notes, Mo., 47.
- rootworm, southern, biology and control, Ala., 158.
- scutellum rot, control, Ill., 346.
- seed, bin method of drying, 571.
- seed, drying experiments, 629.
- seed improvement, W.Va., 35.
- seed, treated, field tests, 748.
- seed, treatment, Ark., 828.
- seedlings, *Penicillium* injury to, 644.
- seedlings, virescent, genetic interrelations, N.Y.Cornell, 724.
- self-fertilized, defects and abnormalities, 622.
- silage. (*See* Silage.)
- smut, notes, 535.
- suckering, factors affecting, Ark., 820.
- supplements for winter feeding of pigs, Ohio, 65.
- sweet. (*See* Sweet corn.)
- tariff data, 575.
- varieties, Ga.Coastal Plain, 728.
- varieties and strains, high yielding, Iowa, 33.
- varieties for North Carolina, N.C., 629.
- varieties, infestation by corn borer, Ill., 352.
- variety infestation by pests, S.C., 651.
- variety tests, Ark., 828; Fla., 325; Ill., 327; Ind., 30; Miss., 31, 128; Mo., 31; N.Dak., 129; S.C., 625; Tex., 626; U.S.D.A., 32.
- vascularization of node in, 123.
- whole and flaked, digestibility for poultry, 868.
- yellow, vitamin A in, Ill., 391.
- yield, effect of blade injury, 519; Ill., 328.
- yield, effect of legumes as residue crops, Ill., 315.
- yield, effect of sweetclover, Ill., 316.
- yield of selfed lines, effect of smut infection, 622.
- yield, relation to ear and grain type, 628.
- yield, relation to seed ear and kernel characters, 427.
- yield, relation to weather, Mo., 31.
- yield, statistical examination, 519.

Cornell University, notes, 797.

Cornstalk borer, lesser, notes, S.C., 651.

Corpora lutea—

and ovarian extracts, effect on oestrus
in guinea pigs, 125.

implants, effects on ovariectomized
monkeys, 325.

in mice, relation to parity, age, and
body weight, 126.

physiology, 126.

Correlation coefficients, meaning and sig-
nificance, 278.

Corrosive sublimate in solutions for seed
potatoes, deterioration, 223.

Corticium vagum, notes, Ark., 845.

Cortinellus shiitake, ergosterol in, 96.

Corvidae of Europe, 240.

Corylus, cytological studies, 510.

Corythuca ciliata, notes, Del., 754.

Cosmopolites sordidus. (See Banana root
borer.)

Cost of production—

power unit as factor, S.C., 677.

route in Jones County, Miss., 575.

(See also specific crops.)

Cotton—

angular leaf spot, studies, 442.

aphid, control, Miss., 53; U.S.D.A., 56.

aphid, studies, Miss., 152.

Ascochyta rot, notes, S.C., 642.

assimilation of nitrates by, Fla., 343.

bacterial disease, development, factors
affecting, 441.

boll rots, notes, S.C., 642.

boll weevil. (See Boll weevil.)

bollworm. (See Bollworm.)

breeding, Ark., 27, 828; Miss., 31, 128.

breeding in China, 620.

cooperative pattern in, treatise, 285.

culture and social life of South, 580.

culture experiments, Ark., 828; Miss.,
31; Okla. Panhandle, 829.

culture, human factors in, 280.

culture under dry land conditions, N.
Mex., 32.

curculionid enemy, studies, 58.

data and 1930 outlook, U.S.D.A., 887.

early maturity in, 520.

economical production, factors in, N.C.,
732.

effect of green manure, Calif., 727.

effect of lime, S.C., 508.

fabrics, artificial soiling for laundering
studies, 398.

fertilizer demonstrations for county
agents, N.C., 487.

fertilizer experiments, Ariz., 520; Ark.,
828; Ga. Coastal Plain, 728; Miss.,
31, 128; S.C., 507, 614.

fertilizer experiments, cooperative, S.C.,
629.

fertilizer formulas for soil types, Miss.,
128.

fertilizer projects for schools of voca-
tional agriculture, N.C., 487.

fiber studies, Ga., 35.

Cotton—Continued.

flea hopper, control, Miss., 56.

flea hopper, effect on cotton plant, 655.

flea hopper, notes, S.C., 650.

flea hopper, paper on, 648.

flea hopper, spring emergence records,
value, 655.

flowers, abscission in, 123.

Fusarium wilt, notes, Fla., 343.

grown in Georgia, quality, Ga., 85.

insect problems in United States, 647.

insects affecting, 653.

insects in Turkestan and the Caucasus,
647.

irrigation studies, Calif., 778.

leaf worm in West Indies, 647.

leaf worm moth, damage to figs, 655.

lintless, occurrence and inheritance,
124.

marketing, cooperative, in Arkansas,
Ark., 670.

marketing, studies, S.C., 676.

notes, Calif., 727.

outlook for 1930, Okla., 784.

pedigree selection, correlations in,
Miss., 128.

plant, fruiting habit, S.C., 221.

pollen, studies, 520.

price, relation to quality, 572.

research, 519; S.C., 629.

Research Station, Trinidad, genetics
research, 513.

root rot sclerotia in nature, 644.

root rot, studies, 145, 442; Tex., 642;
U.S.D.A., 443.

rust, control, Miss., 145.

seed. (See Cottonseed.)

seeding experiments, S.C., 630.

spacing tests, Mo., 31.

square borer, life history, habits, and
control, Tex., 246.

stainers, notes, 443.

staple length, proposed change in, 284.
studies, Tex., 631.

varieties, Ga. Coastal Plain, 728.

varieties for cold resistance, tests,
S.C., 641.

varieties for North Carolina, N.C.,
629.

variety tests, Ala., 732; Ark., 828;
Fla., 325; Miss., 31, 128; Mo., 31;
N.C., 629; S.C., 629, 830.

white fly, notes, 452.

wilt organism, studies, Ark., 845.

wilt resistant varieties, Ark., 845;
Miss., 145.

yield and boll size, effect of notes,
520.

yield in Texas and weather, correla-
tion, U.S.D.A., 806.

Cottonseed—

disinfection tests of commercial dusts
for, Fla., 343.

drying, 274.

hulls, feeding value, Tex., 663.

meal and hulls for lactating cows,
Tex., 663.

Cottonseed—Continued.

- meal, digestibility, N.Mex., 760.
- meal, effect on feces of dairy cattle, 554.
- meal, feeding value, Tex., 660.
- meal for mules, S.C., 661; Tex., 660.
- meal for work horses, Tex., 660.
- meal v. meat scrap for poultry, S.C., 661.
- meal, value for egg production, Mo., 67.
- meal with roughages for fattening lambs, N.Mex., 761.
- treatments, effect on yields, Miss., 145.

Country. (See Rural.)

County—

- boards, large and small, cost of maintenance, N.Y.Cornell, 83.
- Farm Bureau, attitude of farmers toward, 580.
- home demonstration agents, creating sentiment for employment, 88.

Cover crops—

- effect on rubber root disease, 239.
- effect on soil moisture, 815.
- tests, Fla., 325.
- winter, tests, S.C., 33.

Cow testing association, Minnesota, organization, 699.

Cowpeas—

- culture under dry land conditions, N.Mex., 32.
- variety tests, 32; Ark., 828; Tex., 627; V.I., 219.

Cows—

- Brown Swiss, high persistency in, Ill., 370.
- conformation and anatomy relation to producing ability, Mo., 71.
- dairy, pasture for, Miss., 69.
- dairy utilization of nutrients, relation to nutritional plane, Vt., 370.
- mated to proven sires, productive ability, Mo., 70.
- milk production. (See Milk production.)
- native v. grade and purebred, P.R., 768.
- negative to agglutination test for abortion, breeding efficiency, 263.
- pregnant, effect of milking before calving, Mo., 70.
- producing ability, relation to conformation and anatomy, S.C., 664.
- protein requirements, N.Y.Cornell, 766.
- records. (See Dairy herd.)
- (See also Calves and Cattle.)

Crab apple seedlings, French, variability, N.Y.State, 431.

Cranberry—

- blossom worm, studies, 855.
- bogs, leafhoppers in, life history notes, 853.
- false blossom disease, spread, 645, 854.
- false blossom, relation to blunt-nosed leafhopper, N.J., 756.

Crawfish, studies, Miss., 54, 152.

Cream—

- acidity, effect on keeping quality of butter, U.S.D.A., 258.
- bitterweed, removal of bitter flavor from, Tenn., 769.
- cheese, manufacture, N.Y.State, 464.
- commercial sour, manufacturing process, Pa., 258.
- data of U.S. Tariff Commission, 482.
- digestion rate, N.Y.Cornell, 788.
- fat dispersion and casein stability, effect of homogenization, Pa., 373.
- first-grade, production, 166.
- frozen, metallic flavor in, Vt., 259.
- keeping quality, Vt., 259.
- refrigeration experiments, 872.
- sour, neutralizing agents for, Ark., 872.

Creamery license division, report, Ind., 665.

Creatine output, effect of arginine feeding, 693.

Creatinine output, effect of arginine feeding, 693.

Cremastogaster rogenhoferi, Coccidae associated with, 452.*Cremastus*—

- carpocapsae* n.sp., notes, 860.
- rhyacioniae* n.sp., notes, 860.

Oreonitades—

- debilis*, effect on cotton plant, 655.

Creosote treatment of Douglas fir, 672.

Crepis chromosomes, number and morphology, Calif., 723.

Cricket—

- Mormon, control, 154.
- Mormon, life history, habits, and control, U.S.D.A., 654.
- snowy tree, life history, Calif., 751.
- Oriocera asparagi*. (See Asparagus beetle.)
- Oronartium ribicola* and *O. occidentale*, differentiation, 750.
- (See also White pine blister rust.)

Crop—

- and weather data in India, 611.
- land and pasture land, income from, 178.
- reports, U.S.D.A., 85, 286, 388, 681, 887.
- rotations. (See Rotation of crops.)
- yields and soil moisture, Okla., 217.
- yields, effect of changes in climate, 712.

Crops—

- and weather, relation, 611.
- artificial drying, Ill., 382.
- cost and profitability, Ill., 385.
- forecasting, 611, 613.
- green, yield per acre, Miss., 70.
- improvement in Saskatchewan, 220.
- Indian, sterility in, 622.
- nonlegume, inoculation, Iowa, 32.
- on irrigated farms, cost of production, Colo., 281.
- production and value, Ohio, 387.
- production under irrigation, improvement, Mont., 219.

Crops—Continued.

- relation to soil type in Saskatchewan, 136.
- (See also Field crops and specific crops.)
- Crossing over, four-strand, 215.
- Crotalaria—
 - as cover crop in pecan orchards, Fla., 335.
 - diseases of, 47.
 - variety tests, Fla., 325.
- Crown gall—
 - aerial, of apple, 51.
 - bacteriology and anatomy, 146.
 - organism, root production in conjunction with tumors, 439.
 - woolly-knot type of, 50.
- Crows and jays, studies, 240.
- Crucifers, mosaic disease of, 847.
- Cryolite—
 - compatibility with arsenates, 653.
 - use as insecticides, Tenn., 543.
- Cryptorchism in goats, inheritance, Tex., 625.
- Cryptosporidium parvum*, notes, 266.
- Cryptostemma calendulaceum*, feeding experiments, 467.
- Cuckoo, summary, 240.
- Cucullarine, use of term, 376.
- Cucumber—
 - angular leaf spot, notes, Fla., 344.
 - beetle, striped, hibernation, 241, 250.
 - downy mildew, notes, Fla., 344.
 - fruit rot, notes, Fla., 344.
 - insects, notes, N.Y.State, 449.
 - mildew, control, Tex., 642.
 - mosaic, control, N.Y.State, 439.
 - mosaic, studies, Ky., 233.
 - pickles, vitamin C in, 398.
- Cucumbers—
 - fertilizer experiments, Ill., 337; Ohio, 42.
 - prices, relation to quality, 576.
 - variety tests, U.S.D.A., 40.
 - vitamin C in, 398.
- Cucurbits—
 - species and varietal crosses in, Iowa, 43.
 - varieties, N.Y.State, 431.
- Culex fatigans* and associates, breeding habits, 454.
- Culex whitmorei*, notes, 454.
- Culture media—
 - and reagents, treatise, 311.
 - isolation, 321.
 - solid pH determination, Pa., 311.
 - technic, bacteriological, 311.
- Cultures and enzymic digests, control of reaction, 109.
- Culvert pipe, earth pressure experiments, U.S.D.A., 475.
- Curculios—
 - dates of emergence, Del., 754.
 - on chestnuts, U.S.D.A., 251.
- Current leaves, leaching with cold water, 838.

Currants—

- black, breeding, 139.
- black, reversion causes and eradication, 51.
- culture experiments, Alaska, 137.
- Cut-over lands—
 - clearing method-, Idaho, 77.
 - of northern Idaho, Idaho, 82.
- Cuttings, rooting tests, N.Y.Cornell, 736.
- Cutworm bait poisons, tests, 655.
- Cutworms—
 - methods of study, 647.
 - on golf greens, control, 545.
 - pale western and army, forecasting outbreaks, 242.
 - pale western, control, 356.
- Cyathosoma*, new genus, erection, 671.
- Cyclamen mite, control, Ill., 353.
- Cydia pomonella*. (See Codling moth.)
- Cylas formicarius*. (See Sweetpotato weevil.)
- Cylindrocladium macrosporum* n.sp., description, 645.
- Cyperus, cytological studies, 321.
- Cypress, bald, durability, Calif., 742.
- Cypresses, culture, Tex., 641.
- Cystine—
 - deficiency of food in, Ill., 391.
 - relation to sugar in animal hairs, 600.
- Dactylopus longispinus*, on grapes, 246.
- Dacus oleae*, studies, 558.
- Dahlia—
 - leaf spot, notes, 149.
 - spots, fixation, 421.
- Dairy—
 - barns, arrangement and remodeling, 555.
 - barns, stable ventilation in, 555.
 - cattle and dairy cows. (See Cattle and Cows.)
 - coolers in California, 334.
 - cooperatives, paper on, 277.
 - council—a service organization, 556.
 - Day, program, Ohio, 90.
 - equipment, effect of sterilizers, Ill., 372.
 - equipment, sterilization, 466, 478, 884.
 - farming, economic studies, N.Y.Cornell, 481.
 - farming for beginners, U.S.D.A., 369.
 - farming in British Columbia, 481.
 - farming, studies, Vt., 282, 782.
 - farming, treatise, 869.
 - farms, practices on, R.I., 83.
 - herd improvement associations, records, U.S.D.A., 257.
 - herds, breeding records, Minn., 767.
 - industry as basis of colonization in Palestine, 181, 890.
 - industry of Canada, competitive position, U.S.D.A., 339.
 - plant design and equipment, 555.
 - products, stored, keeping quality, Vt 259.
 - program of Oregon, revision, report of convention for, 180.
 - sires. (See Sires.)

Dairy—Continued.

- situation in Panhandle country, Okla. Panhandle, 870.
- washing compounds, alkaline, detergent properties, 466.

Dairying—

- basis for extension programs in, U.S.D.A., 90.
- experiments, Calif., 768; Ill., 371.
- outlook for 1930, 784.
- studies, Kans., 663.

(See also Creamery, Butter, Milk, etc.)

Danysz bacillus in rats, resistance to, inheritance, 514.

Dasheens, culture, P.R., 731.

Dasycephala calycina, notes, 149.

Dasyneura—

- affinis* in southern Italy, 154.
- leguminicola*. (See Clover seed midge.)

Dasyneura piperis n.sp., description, 355.

Datana integerrima. (See Walnut caterpillar.)

Date palm, meta-zenia in, 620.

Date palms, fumigation with chloropicrin, 156.

Davainea proglottina, studies, West.Wash., 541, 558.

Daylight measurement, 611.

Deer—

- death caused by larvae of *Oephenomyia* sp., 157.
- whitetailed, account, 351.

Deficiency diseases. (See Diet deficiency and specific diseases.)

Delaware Station, report, 795.

Dendrophoma obscurans, notes, Fla., 345.

Denitrification in uncultivated soils, 417.

Department of Agriculture. (See United States Department of Agriculture.)

Dermacentor—

- andersoni*, transmission of tularemia to sheep by, 264.
- reticulatus*, transmission of piroplasmiasis by, 548.

Dermatitis of goats, 877.

Dermatitis of sheep, 558, 875, 877.

Dermatomycosis of sheep, 669.

Dewberries, variety tests, Tex., 636.

Dextrose metabolism and nitrogen fixation by *Azotobacter*, N.Y.Cornell, 719.

Diabetes, obesity as precursor, 189.

Diabetic—

- children, diet formulas, 398.
- diets, relation to new analyses of carbohydrate foods, 496.
- food value of dried artichoke powder, 791.

Diabrotica—

- spp. on cucurbits, control, Calif., 753.
- vittata*. (See Cucumber beetle, striped.)

Diactis virginea. (See Ermine moth.)

Diaporthe perniciosa, studies, 444.

Diarrhea, bacillary white. (See Pullorum disease.)

Diaspis samiae—

- fumigation with chloropicrin, 156.
- parasites attacking, 252.

Diatrea, parasites of, 457.

Diatraea saccharalis. (See Sugarcane borer.)

Diet—

- accessory factors. (See Vitamins.)
- deficiency disease, new, produced by fat-free rations, 292.

(See also specific diseases.)

effect on body fat of white rat, 458.

effect on growth and form of rats, 394.

fat requirements in, 293.

for pregnancy, reforms in, 692.

formulas for diabetic children, 398.

in health and disease, handbook, 687.

new artificial, producing avitaminosis C, 198, 588.

of dogs, rôle in fatty degeneration of organs, 695.

vegetarian, growth and reproduction on, 91.

vegetarian, metabolism of rats on, 91.

vitamin A-deficient, histological sections of rats on, Fla., 397.

(See also Food and Nutrition.)

Dietary, American, relation to degenerative disease, 694.

Dietetic guide, course for student dietitians, 687.

Dietetics, laboratory handbook, 90.

Diets—

- fat-free, growth of rats on, 291.
- purified, sterility-producing effect on rats, 194.
- synthetic, hemoglobin maintenance, 190.

Digestion, effect of emotion, 189.

Dill pickles, softening, cause, Calif., 787.

Diocles obliteratus, parasite of grape berry moth, Del., 754.

Diocophyme renalis, parasite of silver foxes, 776.

Dipdust, fungicidal value, 848.

Diphtheria—

- antitoxin production of men, hereditary differences in ability, 824.
- avian, notes, Ill., 380.

Diphthero-variola affection of fowls, 565, 566.

Diplocarpon earliana, notes, Fla., 345.

Diptera—

- of Porto Rico and Virgin Islands, 546.
- photographic reproductions, 156.

Dirofilaria scapiceps in rabbits, 381.

Discula spp., notes, 638.

Disease resistance, genetic basis, 322.

Diseases—

- deficiency. (See Diet deficiency diseases.)
- degenerative, relation to American dietary, 694.
- epidemic, and climate, 648.

Diseases—Continued.

- of animals. (*See* Animal diseases and specific diseases.)
- of man and animals, 559.
- of plants. (*See* Plant diseases and specific host plants.)
- transmitted from animals to man, 668.
- transmitted through milk, 555.
- Disinfectants, standardization, 667.
- Dodder, eradication, Ind., 834.
- Dog distemper—
 - cause and prevention, 265.
 - immunization against, 265.
- Dogs—
 - absorption and deposition of aluminum in, 585.
 - parasites of digestive tract, 265.
 - Pekingese, segregation of skull form, 422.
 - physical examination, 260.
 - variations in, 421.
- Dolomites, behavior, effect of calcium-magnesium ratio, 818.
- Domestic science. (*See* Home economics.)
- Dominance, Fisher's theory, 513.
- Dominance, origin of, 512.
- Dominion Grain Research Laboratory, reports, 429.
- Doryloxenus from Java and host change, 649.
- Douglas fir—
 - creosote treatment, 672.
 - growth rate, Calif., 742.
 - leaf-cast disease, 149.
 - sterilization of seed beds, 640.
- Dourine eradication in Arizona, 564.
- Doves, ring, thyroid races in, 823.
- Drainage—
 - channels, water flow in, U.S.D.A., 671.
 - effect on swamp forests, 531.
 - farm, U.S.D.A., 271.
 - water studies, Ill., 314.
- Drill shares, wear tests, 673.
- Drosophila amelophila*. (*See* Pomace fly.)
- Droughts and floods, British, treatise, 314.
- Dry cleaning, effect on unweighted and weighted silk, 794.
- Duck disease, blood chemistry studies, 269.
- Dulichium, cytological studies, 321.
- Dyes—
 - bacteriostatic, use in isolation of *Rhizobium leguminosarum*, 816.
 - new food, chemistry and analysis, U.S.D.A., 808.
 - use in isolating nitrite-oxidizing organisms, 417.
- Dysdercus* spp. (*See* Cotton stainers.)
- Dysentery, chronic bacterial. (*See* John's disease.)
- Ear mange in foxes, 471.
- Earth pressure experiments on culvert pipe, U.S.D.A., 475.
- Eccoptogaster* (*Scolytus*) *quadrispinosus*. (*See* Hickory bark beetle.)

- Ecological factors, measurement and effects, 648.
- Ecology, agricultural, treatise, 314.
- Economic—
 - information, extending to farmers, 89.
 - research, experimental method in, 572.
 - survey of Dixie section, Utah, 886.
- Edema in rats, production, 789.
- Education—
 - agricultural. (*See* Agricultural education.)
 - part-time, trends in, 186.
 - vocational. (*See* Vocational education and Agricultural education, vocational.)
- Egg—
 - albumin. (*See* Albumin, egg.)
 - production—
 - effect of feeding cod-liver oil, Mo., 67.
 - effect of green feed substitutes, 553.
 - low, inherited causes, N.J., 69.
 - of pullets, effect of first laying date, Mo., 68.
 - of pullets, with and without artificial light, Miss., 67.
 - records, statistical study, 514.
 - studies, V.I., 250.
 - time factor in, W.Va., 663.
 - winter, all-night lights for, Ohio, 369.
 - winter, effect of artificial light, Mo., 68.
 - yearly, estimation, Miss., 66.
 - (*See also* Hens, laying.)
 - products, dehydrated, use in ice cream, 465.
 - yolk in ice cream, use, 166.
 - yolk, pH changes during incubation, 827.
- Egg-laying—
 - contest, Panhandle, report, Okla. Panhandle, 69, 461, 766.
 - contests, New Jersey, report, N.J., 663.
- Eggplant leaf miner in tomatoes, shipped from Mexico, 241.
- Eggplants—
 - culture experiments, V.I., 227.
 - varieties, N.Y. State, 431.
- Eggs—
 - foreign trade in, U.S.D.A., 388.
 - hatchability, effect of green feed substitutes, 553.
 - hatchability inheritance, Pa., 368.
 - hatchability, relation to coefficients of inbreeding, 552.
 - incubation. (*See* Incubation.)
 - iron and copper in, effect of hens' diet, 789.
 - laid by a hen, feed purchasing power, Mo., 68.
 - marketing, S.Dak., 85.
 - nonfertile incubator, sterilization, Pa., 380.

Eggs—Continued.

- of hens receiving cod-liver oil, vitamins in, N.Y.Cornell, 788.
- preservation, S.C., 661.
- quality, studies, Calif., 764.
- storage experiments, N.Mex., 257.
- variation in hatchability, Tex., 662.

Eggshell thickness, effect of vitamin D, Ky., 256.

Egyptianella pullorum n.g. and n.sp., description, 566, 775.

Eimeria—

- acervulina* n.sp., notes, 266.
- avian life cycle, prepatent and patent periods in, 171.
- dispersa* n.sp., notes, 266.
- maxima* n.sp., notes, 266.
- meleagridis*, notes, 266.
- meleagrimittis* n.sp., notes, 266.
- mitis*, n.sp., notes, 266.
- phasiani* n.sp., notes, 266.
- spp. in gallinaceous birds, 267.
- spp. of domestic rabbits, 566.
- tenella*, notes, 266.
- truncata*, notes, 267.

Elasmopalpus lignosellus. (See Cornstalk borer, lesser.)

Elasmus johnstoni n.sp., notes, 861.

Elder—

- borer, parasites of, bionomic notes, 545.
- leaf tyer, parasites of, bionomic notes, 545.

Electric—

- brooders, air flow in, Calif., 765.
- motor requirements for agriculture, Pa., 382.
- plant, individual, summary, 571.

Electrical statistics for California farms, Calif., 382.

Electricity—

- cost of using for farm operations, Mo., 77.
- costs and uses on farms, S.Dak., 272.
- for home electric refrigerators, costs, S.Dak., 99.
- for soil heating, 672.
- in agriculture, 173.
- on farms in New York and Canada, N.Y.Cornell, 780.

Electrification, rural, trend in, 571.

Electrode for micro-pH determination, 11.

Electrolytes, lectures on, 310.

Eleocharis, cytological studies, 321.

Elevators, financial operations of, 386.

Eli Whitney Forest, conditions and management, 843.

Elm leaf beetle, studies, Ark., 851.

Elm scale, European, summary, 56.

Embryonic segregation, rôle in life history, 511.

Embryos—

- growth and implantation after early ablation of ovaries, 126.
- of eight days' gestation in mice, variations in, 125.

Emenadia cucullata, economic value, 546.

Emmer, variety tests, N.Dak., 129.

Emotion, effect on digestive tract, 189.

Empoasca fabae, injurious to clover and alfalfa, Ky., 245, 355.

Empoasca mali. (See Apple leafhopper.)

Empusa fressenii, infection of citrus aphid by, Fla., 345.

Emulsions in theory and practice, 801.

Encapsulatus genitalium, notes, Ky., 263.

Encyrtinae of Japan, 861.

Endoconidophora coeruleascens, notes, 538.

Energy cost of operating a vacuum cleaner, 198.

Engineering—

- agricultural, in land-grant colleges, 89.
- agricultural, research opportunities in, 567.
- agricultural, status in United States, 474.
- climatic cycles in, U.S.D.A., 504.
- education, papers on, 89.
- extension instruction in land-grant colleges, 89.
- industrial and management in curricula of land-grant colleges, 89.
- research in land-grant colleges, 89.
- research lines, 88.

Engines—

- automotive, model air cleaners for, Calif., 776.
- automotive, oil filters for crank cases, Calif., 777.
- operation experiments, cold carburetion, 882.

Enteritis—

- chronic. (See Johnes' disease.)
- of swine, studies, 878.

Enterohepatitis, infectious. (See Black-head.)

Entomofauna, Permian, of North Russia and Kansas, 649.

Entomological—

- bibliography, need for, 241.
- exhibits, wax, method of preparing, 541.
- record, 1928, 541.
- science in Egypt, development, 649.
- work, agricultural, in France, 650.

Entomology—

- development, share of Netherlands in, 648.
- history, 539.
- in Peru, status, 852.
- international aspects, 241.
- relation to meteorology, 611, 613.
- technic applicable to, 850.
- (See also Insects.)

Entomoscelis adonidis, paper on, 649.

Enzymes—

- action, mechanism, and associated cell phenomena, treatise, 309.
- actions and properties, treatise, 309.
- chemistry, treatise, 309.

- Ephestia*—
cautella outbreak in California, 241.
kuehniella. (See Flour moth, Mediterranean.)
- Epicauda suavis* in Russia, 542.
- Epididymis, function, 125.
- Epiglaea apiata*, studies, 855.
- Epilachna corrupta*. (See Bean beetle, Mexican.)
- Epinephrine, rôle in carbohydrate metabolism, 595.
- Epitrix cucumeris*. (See Potato flea beetle.)
- Epitrix subornita*, notes, West. Wash., 540.
- Ergosterol—
 absorption spectra studies, 805.
 heat of combustion, 693.
 in Japanese edible mushroom, 96.
 irradiated, antirachitic principle, 590.
 irradiated, effects of large doses, 196, 197, 296, 591, 592.
 irradiated, in rabbits, action, 590.
 irradiated, in the treatment of rickets and tetany, 590.
 irradiated, monomolecular films of, 606.
 irradiated, studies, 898.
 irradiated, toxicity, 96.
 photochemical reactions, 502, 804.
 remarkable stability, 588.
- Eriophorum, cytological studies, 321.
- Eriophyes*—
gossypii, studies, 548.
lwoi new to Britain, 360.
- Eriosoma lanigerum*. (See Apple aphid, woolly.)
- Ermine moth—
 notes, 852.
 on apple and cherry, 156.
 parasites, host relations, 860.
- Erysiphe cichoracearum*, control, 145.
- Erythrocytes, regeneration, 596.
- Erythroneura*—
maculata maculata, notes, Del., 754.
vitis, notes, Del., 754.
- Esca of grapevines, 849.
- Escherichia coli*, effect of irradiation, Pa., 320.
- Ether, purification and preservation, 310.
- Ethyl trichloracetate, anthelmintic value, 877.
- Ethylene dichloride-carbon tetrachloride fumigation process for dried fruit, 454.
- Eublemma amabilis*, notes, 542.
- Eulia politana* on pine seedlings, 450.
- Eulimneria crassifemur*, morphology and biology, 860.
- Eumerus* spp., notes, West. Wash., 59.
- Eupelmus cyaniceps*, parasite of boll weevil, U.S.D.A., 359.
- Euphorbia*—
eremophila, feeding experiments, 558.
peplus, feeding experiments, 467.
- Euphorbia tida*, breeding place, 541.
- Euplectrus bicolor*, notes, 855.
- Euproctis chrysorrhoea*. (See Brown-tail moth.)
- Eurytoma*—
braconidis n.sp., notes, 861.
tylodermatis, parasite of boll weevil, U.S.D.A., 359.
- Euscelis*—
stactogalus, parasite of, 457.
striatulus, life history notes, 853.
striatulus, relation to cranberry false blossom, 645, 854; N.J., 756.
- Eutettis*—
chenopodii, life history and spotting habits, 245.
tenella. (See Beet leafhopper.)
- Euthrips tritici*. (See Flower thrips.)
- Euzesta notata*, notes, 455.
- Euzoa*—
segetum abundance, atmospheric deposits as regulators, 243.
segetum, papers on, 542.
segetum parasites, host relations, 860.
tritici, notes, 542.
 (See also Cutworms.)
- Evaporation—
 in freezing weather, measurement, 114.
 type coolers, performance tests, 479.
- Evetria buoliana*, studies, 855.
- Evolution—
 continuous or discontinuous process 821.
 Darwin's and Lamarck's theories, 620.
- Ewes—
 breeding, wintering, Miss., 162.
 pregnant, acidosis of, Ky., 254.
 pregnant, cost of wintering, S.C., 659.
 range, feeding and finishing, Nev., 62.
 (See also Sheep.)
- Experiment Station—
 an institute for research in rural affairs, 88.
 director, relationships and responsibilities, 88.
- Experiment stations—
 bulletins, 1927 and 1928, list, U.S.D.A. 795.
 forest. (See Forest.)
 (See also Alaska, Arkansas, etc.)
- Extension—
 methods, costs, 89.
 programs in home economics, dairying and forestry, U.S.D.A., 90.
 service, relation to cooperation, 681.
 work, cooperative, 1927, U.S.D.A., 287.
 work, effect on rural life, 88.
- Extractors, simple, construction, 607.
- Eye defects in rabbits, 217.
- Fabrics, cotton, wearing quality, effect of laundering, Mo., 97.
 (See also Textiles.)
- Families, farm and city, income and expenditures, Minn., 389.
 (See also Farm families.)
- Family names, selection, 649.
- Fannia* larvae causing myiasis of urinary passages, 541.

Farm—

- and city families, income and expenditures, Minn., 389.
- and shop, 88.
- animals. (*See* Livestock and Animals.)
- budgeting in Germany, 573.
- buildings, convenient arrangements for, N.Y.Cornell, 80.
- buildings, plans and costs, Ark., 880.
- business analysis, Mich., 480.
- credit. (*See* Agricultural credit.)
- drainage, U.S.D.A., 271.
- earnings, Ill., 385.
- economics, problems, 275.
- equipment, antifriction bearings, 175.
- equipment, horses and tractors, Iowa, 83.
- equipment, mechanical, research in, 571.
- export debenture plan, 578.
- families and rural organizations, Wis., 784.
- homemakers, use of time by, Oreg., 496.
- homes, designs for Kansas, 674.
- household expenditures, Vt., 298.
- households in Ohio, occupational history, Ohio, 387.
- houses, costs, 177.
- implement parts, applications of oxy-acetylene welding process, 275.
- labor. (*See* Agricultural labor.)
- machinery. (*See* Agricultural machinery.)
- migration in selected communities, Wash.Col., 87.
- or forest in the West Virginia Appalachians, 276.
- organization—
 - and farm power, relation, Ind., 679.
 - and management, Ill., 385; S.C., 676.
 - and operation, Mo., 82.
 - in countries of Europe, 276.
 - of Dixie section, Utah, 886.
 - studies, Ky., 278.
- organizations, programs, 682.
- power and farm organization, relation, Ind., 679.
- products. (*See* Agricultural products.)
- real estate, annual changes in, 276.
- real estate situation, U.S.D.A., 573.
- real estate, valuation, U.S.D.A., 782.
- real estate values in Ohio, 483.
- real estate values in Ohio, index, 483, 886.
- relief measures in Europe, 884.
- shop plans and use, 275.
- supplies, purchase, credit in, 579.
- taxation in New York, N.Y.Cornell, 84.
- welfare statistical program, 580.

Farmers—

- cooperative organizations in New Jersey, N.J., 285.

Farmers—Continued.

- economic conditions in Oklahoma, Okla., 485.
- response to price, 283.
- white, conditions in cotton piedmont, U.S.D.A., 280.
- Farming—
 - conditions, indications, 885.
 - dairy. (*See* Dairy farming.)
 - in Minnesota, types, Minn., 677.
 - large-scale, 178.
 - systems for Purchase Region, Ky., 178.
 - systems on Salt River Valley irrigation project, 282.
 - (*See also* Agriculture.)
- Farms—
 - abandoned, in New York, 276.
 - electricity on. (*See* Electricity.)
- Fasciola hepatica*—
 - bionomics, 563.
 - intermediate host, P.R., 771.
- Fat—
 - deficiency, disease caused by, 292.
 - determination in milk, 408.
 - in body of rat, effect of diet, 291, 458.
 - requirements in diet, 293.
- Fats—
 - digestion rate, N.Y.Cornell, 788.
 - inedible animal, in United States, treatise, 711.
 - tariff on, 888.
 - (*See also* Oils.)
- Fat-soluble A. (*See* Vitamin A.)
- Fatty foods, vitamin A in, 111.
- Fauna of a dying tree, 649.
- Feather growth rate in Plymouth Rock chicks, 624.
- Feather mites, control, 671.
- Feathers developing on skin grafts in fowls, characteristics, 217.
- Feces—
 - of foot-and-mouth disease affected animals, infectivity, 168.
 - of rachitic children, pH and composition, 197.
- Federal—
 - Board for Vocational Education, report, 89, 685.
 - Farm Board, papers on, 884.
 - Farm Board, problems, 484.
 - Farm Loan Board, report, 283.
- Feed cutters, energy requirements, Kans., 383.
- Feed grinders, energy requirements, Kans., 383.
- Feeding—
 - experiments. (*See* Cows, Pigs, etc.)
 - of farm animals, treatise, 160.
- Feeding stuffs—
 - American, energy-production coefficients, Tex., 252.
 - cheaper winter, growth, 862.
 - copper in, 457.
 - inspection and analyses, Ind., 657; Ky., 380; Ma., 160; N.H., 360; N.J., 60; Vt., 760.
 - treatise, 501.

- Fence post treatments, Mo., 77.
Ferns, fungus diseases, Fla., 344.
Ferric citrate as supplement to swine rations, Ill., 365.
Fertility studies on Kirkland soil, Okla., 211.
Fertilizer—
 attachments on corn planter, tests, 272.
 experiments, Idaho, 22; Ind., 22; Ky., 210; Mo., 17; Tex., 614.
 (See also special crops.)
 formulas, tests, Miss., 22.
 materials from small-scale slaughter of animals, U.S.D.A., 121.
 materials, principles, 501.
 recommendations for specific crops, N.C., 615.
Fertilizers—
 analyses, Ind., 508; Ky., 508; Me., 508; N.J., 721; Vt., 213.
 analyses and uses, Tex., 213.
 drillability, factors affecting, 883.
 effect on protein content of crops, S.C., 615.
 inspection and analyses, Conn.State, 418; Mo., 721; R.I., 121.
 nitrogenous. (See Nitrogenous fertilizers.)
 on corn, use, Mo., 16.
 paper on, 220.
Fescues, identifying, 136.
Field—
 crops work in Porto Rico, 32.
 crops work under dry land conditions, N.Mex., 32.
 (See also Crops, Forage crops, Root crops, etc.)
 experiments, 518.
 plat tests, experimental error in, 424.
Fig—
 diseases, transmission, Calif., 745.
 moth outbreak in California, 241.
 psyllid, notes, 154.
 rust, control, Tex., 636, 642.
 trees, irrigation, Calif., 734.
Figites striolatus, notes, 860.
Figs—
 cultivation methods, Miss., 38.
 culture experiments, Tex., 636.
 pruning, Tex., 636.
Filberts, variety tests, Mo., 39.
Fir, second-growth, yields, U.S.D.A., 531.
Fire ants, control, 448; Tex., 652.
Fire blight—
 hosts, Ark., 845.
 nature and control, Okla.Panhandle, 645.
 pathogen, life history, Ark., 444.
 pathogen within living tissues, studies, 849.
Fires—
 forest. (See Forest fires.)
 on farms, cause and prevention, U.S. D.A., 82.
Fish meal—
 as pasture supplement for pigs, 163.
 hand-feeding v. free-choice feeding to hogs, S.C., 660.
Fish oils, vitamin A assays of, comparison, 111.
Flacherie in silkworms, relation to blood constituents, 452.
Flagellates from ruffed grouse, 671.
Flat-headed borer, studies, Miss., 53, 152.
Flax—
 boll, dehiscence, 427.
 cropping with cereals, U.S.D.A., 330.
 seeding experiments, Calif., 727.
 straw, physical and chemical characteristics, 830.
 variety tests, N.Dak., 129.
Flaxseed—
 data of U. S. Tariff Commission, 482.
 feeding value, Ohio, 66.
 moisture relations, 427.
Flea larva, chalcidoid parasite from, 159.
Fleas—
 on rodents and insectivores in Nigeria, 358.
 sound apparatus, 649.
Files—
 control, 449.
 house. (See House files.)
 musoid, parasites of, 860.
 photographic atlas, 156.
 repellents for, Tex., 666.
 white. (See White fly.)
Floods and droughts, British, treatise, 314.
Florida Station, notes, 400.
Florida Station, report, 399.
Flour—
 ashing, new aids in, 710.
 baking quality, relation to pH and buffer value, 288.
 baking test, standard, 488.
 bleaching, detection, 205.
 diastatic power, relation to crust color, 288.
 English, grading and marking, 285.
 loaf volume under prolonged fermentation, 489.
 moth, Mediterranean, parasite of, 154.
 types and grades, buffer intensities of water extracts, 709.
 whole wheat, value, 583.
 (See also Bread.)
Flower thrips, notes, Fla., 352.
Flowers—
 culture, Alaska, 137; Can., 637.
 variety tests, Alaska, 137.
 (See also Plants, ornamental.)
Flukes of human blood, life history film, 241.
Fluosilicates, compatibility with arsenates, 653.
Fly attack and animal coloration, 647.
Fly survey of Punjab, 377.
Fodder crops. (See Forage crops.)
Follicular extract injection, effect on sex organs, 127.

Food—

allergies, identification, diets for, 394.
 dislikes, overcoming, 688.
 for the family, treatise, 686.
 investigation, index to literature, 287.
 materials, German, vitamins in, 395.
 plants, 321.
 preservation, treatise, 686.
 served to college students, nutritive value and cost, U.S.D.A., 187.
 supplies of Great Britain, 890.
 ultra-violet irradiation, large-scale methods, 593.
 (See also Diet)

Foods—

and fuel, home-produced, consumed by farm households of State, value, Ohio, 677.
 canned. (See Canned foods.)
 carbohydrates in, 488.
 distribution in large cities, treatise, 579.
 fresh, aluminum in, 586.
 infant, commercially prepared, organisms in, 392.
 infant, commercially prepared, sanitary control, N.Y. State, 392.
 of foreign-born, relation to health, 687.
 regulating sale of, 555.
 studies, Ill., 390.
 vitamins in, U.S.D.A., 293.
 (See also specific foods.)

Foot rot in sheep, treatment, Calif., 771.

Foot-and-mouth disease—

in Great Britain, data, 260.
 outbreak in California, 263.
 summary, 875.
 virus, effect of irradiation, 669.
 virus in urine, feces, bile, and milk, 168.

Forage—

crops—
 combinations, Ill., 328.
 feeding value, Alaska, 160.
 for pigs, Del., 763; Ohio, 660.
 outlook for 1930, Okla., 784.
 phosphorus in, effect of fertilizers, 549.
 tests, V.I., 219.
 variety tests, N.Dak., 129.
 grasses, variety tests, 32.
 plants, effect of phosphatic fertilizers, Mont., 210.
 plants, Philippine, composition, 686.
 poisoning. (See Livestock poisoning, Plants, poisonous, and specific plants.)

Foreign trade of United States, U.S.D.A., 388.

Forest—

administration. (See Forestry.)
 botany, Vt., 343.
 Eli Whitney, conditions and management, 843.
 Experiment Station, Southern, report and program, U.S.D.A., 843.
 fire hazard, factors affecting, Wis., 15

Forest—Continued.

fire lines around forest lands, S.C., 641.
 fires and cover type in California forests, U.S.D.A., 232.
 fires, prevention, S.C., 641.
 fires, relation to humidity, 313.
 insects, control, 647.
 insects, destructive, field book, 451.
 insects, occurrence, use of quadrats in determining, 649.
 lands, maintaining production and increasing output, U.S.D.A., 45.
 lands, taxation, Ohio, 844.
 news of the State, Ohio, 743.
 plantations at Biltmore, North Carolina, U.S.D.A., 742.
 planting in Lake States, U.S.D.A., 45.
 policy for North Carolina, 144.
 reserves, vanishing, treatise, 843.
 taxation inquiry, report, U.S.D.A., 342.
 trees. (See Trees.)
 types, effect on forest fires, Wis., 15.
 use, economic feasibility, 276.

Forestry—

and larch sawfly, 648.
 at Coastal Plain Substation, Miss., 144.
 at Texas Station, Tex., 641.
 basis for extension programs in, U.S.D.A., 90.
 Inter-American Conference on, notes, 400.
 light and moisture in, 530.
 studies, Pa., 342.

Forests—

and mankind, treatise, 843.
 and water in Japan, relations, 232.
 in Vermont, rainfall and width of annual rings, Vt., 232.
 national, of northern California, cover type and fire control, U.S.D.A., 232.
 Swedish, soil fauna of, 649.

Formica—

exsectoides, associated with treehoppers, 861.
rufa, biology, 450.

Fort Lewis, a community in transition, 581.

Fortunella hindsi, botany and history, 421.

Foulbrood—

American, notes, Tex., 652.
 European, of bees, etiology, 650.
 4-H club work, greater development, 88.

Fowl—

cholera, epidemiology, 670.
 diphtheria immunization, 566.
 disease, new infectious, in Korea, 260.
 paralysis, studies, 172; Fla., 874.
 pox, control, 472, 473; N.H., 472.
 pox immunization, 566, 774.
 pox, studies, 375; West Wash., 557.
 pox transmission by mosquitoes, 774.
 pox vaccination, effect on healthy pullets, 473.
 pox vaccination, methods, Calif., 771.

Fowler's solution, effect on spermatozoa, Ill., 376.

Fowls—

- anatomy and hygiene, 266.
- castrated, effects of testis extracts, 624.
- hereditary factors in, 822.
- integumental grafting in, 423.
- intermediate rumplless, morphology, 30.
- interspecific hybrids, 725.
- leg feathering, genetics, 624.
- post-mortem method with the anatomy, 260.
- rumpllessness in, 324.
- sex dimorphism and variability in leg and wing bones, 624.

(See also Chickens, Hens, Poultry, etc.)

Fox farming, sanitary requirements, U.S.D.A., 351.

Foxes—

- ear mange in, 471.
- silver, nematode parasite, 776.

Francaella colchica, experimental infection, 469.

Frankliniella fusca, notes, S.C., 650.

Freemartin condition in swine, 825.

Freemartins in cats, potential, 325.

Frost warning service of Weather Bureau in San Joaquin Valley, U.S.D.A., 504.

Fructose fermentation by organisms from tomato products, N.Y.State, 10.

Fruit—

- beetles, carriers of yeast and bacteria to fruits, Calif., 744.
- breeding, progress in, 139.
- bud formation, factors affecting, 139.
- die-back, studies, 444.
- farming in British Columbia, 481.
- farms, profits from, N.Y.Cornell, 781.
- flies of Queensland, 853.
- fly, Mediterranean—
 - control in Florida, 157.
 - eradication work, 546.
 - in Brazil, 455.
 - in Florida, 57.
 - measures to prevent introduction, 157.
 - notes, 451, 852.
 - papers on, 358.
 - search for, S.C., 650.
- fly, Natal, control, 546.
- fly problem in Mexico, 647.
- fly surveys in Argentina, Spain, and Canary Islands, 157.
- fly, West Indian, in Porto Rico, 153.
- fresh, marketing in Europe, U.S.D.A., 182.
- growing, textbook, 638.
- growing, treatise, 228.
- insects, notes, N.Y.State, 449.
- moth, oriental. (See Peach moth, oriental.)
- production relation to meteorological research, 611, 612.
- setting studies, N.Y.Cornell, 739; Ohio, 41.
- tree capsid pests in England, 647.

Fruit—Continued.

- tree leaves, leaching with cold water, 838.
- tree shoots, transpiration rates, Ill., 839.
- trees, dates of fertilizer application, Can., 836.
- trees, fertilizer experiments, 839; Miss., 39.
- trees, Indian, sterility in, 622.
- trees, ornamental dwarf, culture, 838.
- trees, response to pruning, N.Y.Cornell, 737.
- trees, root and crown injury due to freeze, N.Y.Cornell, 746.
- trees, young, pruning, Mich., 229.
- trees, young, pruning and training, Utah, 838.

Fruits—

- and fruit products, summary, U.S.D.A., 312.
- Australian, exported to England, wastages in, 850.
- car-lot shipments, U.S.D.A., 887.
- citrus. (See Citrus fruits.)
- culture, Can., 637; Ga.Coastal Plain, 736.
- culture experiments, 138; Alaska, 137.
- culture in Porto Rico, 42.
- distribution by wholesalers and jobbers, N.Y.Cornell, 680.
- dried, fumigation, 454.
- dried, preparation and storage, Calif., 786.
- hardiness, 513.
- hardy, pollination, 543.
- immature, and flowers, dropping, Del., 749.
- new or noteworthy varieties, N.Y.State, 738.
- outlook for 1930, Okla., 784.
- perishable, transportation and storage studies, Ill., 337.
- Philippine, composition, 686.
- physiology, 840.
- pollination, N.Y.State, 738.
- ripening, optimum temperatures, Calif., 734.
- seedling stocks, N.Y.State, 432.
- small, culture, treatise, 228.
- small, preservation, frozen-pack method, U.S.D.A., 787.
- small, variety tests, Miss., 38.
- stone, sour sap and gummosis, origin, Calif., 745.
- storage and transport temperatures, optimum, 139.
- storage in artificial atmosphere, 841.
- storages, insulation, Pa., 81.
- studies, Can., 524.
- varieties, W.Va., 228.
- variety tests, Alaska, 137; Miss., 137.
- vitamin C in, factors affecting, 295.
- vitamins in, 395.
- (See also Orchards, Apples, Peaches, etc.)
- Fuckelia conspiciua*, notes, 537.

Fuels—

- effects of knock-suppressing and knock-inducing substances, 272.
- engine, of antiknock quality, detonation characteristics, 882.

Fumigants, effect on seed germination, 510.

Fumigation, use of carbon dioxide in, 152.

Fungi, film-forming, studies, Calif., 504.

Fungicide-insecticide combinations, new, 646.

Fungicides—

- against *Sphaerotheca humuli*, 532.
- analyses, N.J., 524.
- chemical composition, Oreg., 524.
- preparation and use, Oreg., 839.
- tests for peach bacterial spot, Ill., 346. (See also Sprays and specific kinds.)

Fur farming—

- and zoology, applied, 241.
- treatise, 462.

Fur-bearing animals, laws, U.S.D.A., 351.

Fusarium—

- culmorum*, notes, 534.
- lycopersici*, studies, Mo., 50.
- oxysporum medicaginis* host plants, 48.
- oxysporum medicaginis*, temperature and moisture relations, 747.
- sp., notes, Miss., 145.
- spp., notes, 145.
- vasinfectum*, notes, Ark., 845; Fla., 343.

Fusicladium—

- dendriticum*. (See Apple scab.)
- spp., notes, 238.

Galba bulimoides, sheep liver fluke larvae in, Calif., 752.

Galerucella luteola. (See Elm leaf beetle.)

Gall—

- midges of peas, British, 357.
- mite, new, on pecan, Miss., 53.
- mites of lilac, 360.

Galleria mellonella. (See Wax moth.)

Game—

- birds for naturalizing in United States, U.S.D.A., 447.
- birds, propagation, U.S.D.A., 646.
- laws for 1929-30, U.S.D.A., 240.
- protection, directory of officials for, U.S.D.A., 52.

Garden insects, control, 450.

Gardening—

- in southern California, manual, 842.
- landscape, Miss., 143.
- treatise, 228.

Garlic, wild, characteristics and control, U.S.D.A., 38.

Gas engines. (See Engines, automotive.)

Gaseous explosions—

- effect of tetraethyl lead, 570.
- effect of tetraethyl lead, hot surfaces, and spark ignition, 882.

Gastritis in sheep, treatment, 167.

Gastro-enteritis in sheep, treatment, 558.

Gastrophilus pecorum, oviposition, 858.

Geese housing, feeding, and management in South Africa, 462.

Gelechia—

- confusella*, notes, 241.
- gossypiella*. (See Bollworm, pink.)

Genes—

- action of, 420.
- in different quantities, comparative effects, 124.

Genetic correlations in quantitative inheritance, 623.

Geology of North Dakota, 672.

George-Reed Act, provisions of, 89.

Georgia—

- Coastal Plain Station, report, 796.
- Station, notes, 200, 600.

Station, organization and work, 99.

Geraniol bait as attractant for Cicadidae, 653.

Geranium aphid, parasite and hyperparasites of, 861.

Ginghams, wearing quality, effect of laundering, Mo., 97.

Ginseng *Alternaria* blight, control, Ohio, 644.

Gipsy moth, imported insect enemies, U.S.D.A., 356.

Girls' play suits for winter, U.S.D.A., 598.

Gladolus—

- bacteriosis, 538.
- bulbs, hot water tests, 145.
- culture, 529; S.C., 636.
- mosaic disease, 645.
- winter forcing, length of day as factor, Ill., 337.

Glanders—

- diagnosis, 167.
- in Great Britain, data, 260.

Glass substitute, durability, 462.

Glucose, fermentation—

- by nodule bacteria, 414.
- by organisms from tomato products, N.Y.State, 10.

Glutelin, physicochemical properties, 202.

Glycerol administration, effect on glycogen in liver of rats, 693.

Glycinin A, physicochemical properties, 202.

Glycinin B, physicochemical properties, 202.

Glycogen—

- in liver, effect of administration of glycerol, 693.
- physiology, 595.

Glypta mutica, parasite of grape berry moth, Del., 754.

Goat—

- butter and cream, digestion rate, N.Y. Cornell, 788.
- grass as weed pest in wheat fields, 137.
- lice control, Tex., 666.

Goats—

- Angora, and mohair industry, U.S. D.A., 460.

Goats—Continued.

- Angora, body and fleece weights, Tex., 659.
- Angora, inheritance of ridgeling characteristic, Tex., 625.
- duration of gestation in, variation, 664.
- inheritance in, 29.
- meat infested with *Hypoderma crossi* as human food, 773.
- production in range country, U.S.D.A., 160.
- treatise, 459.
- variations in, 421.
- Golter, endemic—
 - distribution in United States, 191.
 - in Tennessee, 97.
- Goldenrod, rayless, poisonous to livestock, U.S.D.A., 75.
- Golf greens, cutworms on, control, 545.
- Gonad cross-transplantation in Leghorn and Campine, 30.
- Gonads, growth in birds, 515.
- Gooseberries—
 - breeding, Ill., 337.
 - culture experiments, Alaska, 137.
- Gooseberry—
 - leaves, leaching with cold water, 838.
 - mildew, control, 537.
- Gossyparia spuria*. (See Elm scale, European.)
- Graft unions, faulty, cause, Mich., 434.
- Grafting, preliminary budding in, Mich., 434.
- Grain—
 - beetle, saw-toothed, in rice mills, Ark., 851.
 - farming, fertility plans for, Ill., 315.
 - plats, removing borders from, 131.
 - rations for hogs on soybeans, S.C., 660.
 - storage data, U.S.D.A., 81.
- Grains—
 - drying experiments, 430.
 - feed, outlook for 1930, Okla., 784.
 - preparing for lambs, Tex., 659.
 - small, fertilizer experiments, Calif., 727.
 - small, seeding experiments, Ga.Coastal Plain, 728.
 - (See also Cereals and Oats, Rye, Wheat, etc.)
- Granary weevil in stored grain, 450.
- Grape—
 - berry moth, life history studies, Del., 754.
 - chlorosis, treatment, 849.
 - colaspis damage to corn, control, Ill., 352.
 - concentrates, studies, Calif., 786.
 - industry in Missouri, economic position, Mo., 482.
 - insects, notes, N.Y.State, 449.
 - juice, powdered, Calif., 786.
 - Kahalili, new variety, N.Y.State, 431.
 - leaf roller problem in Hungary, 241.
 - pigments, studies, N.Y.State, 9.

Grape—Continued.

- powdery mildew, control in California, 238.
- root rot, notes, Tex., 637.
- stocks, phyloxera resistant, and soil types for, 435.
- Grapefruit—
 - culture, Tex., 637.
 - effect of boron, 142.
 - fallen, *Phytophthora* infections, P.R., 747.
 - hybrids, susceptibility to scab, P.R., 747.
 - notes, Fla., 335.
 - shipments, Fla., 338.
 - trees, treatment for gummosis and scaly bark, Tex., 642.
- Grapes—
 - Australian, exported to England, wastage in, 850.
 - breeding, Calif., 735.
 - California table, handling, U.S.D.A., 528.
 - carbohydrate metabolism, effect of dormant pruning, Calif., 140.
 - colorless sprays for, Del., 745.
 - Concord, profitable pruning, Mich., 435.
 - culture, West.Wash., 523.
 - culture, limiting, 277.
 - culture, treatise, 140.
 - descriptive notes, N.Y.State, 431.
 - European, on American roots, notes, Miss., 38.
 - fertilizer experiments, Ark., 835; Miss., 39.
 - insect enemies, biological control, 852.
 - keeping qualities, Ill., 336.
 - mite affecting, Calif., 752.
 - new varieties, N.Y.State, 431, 738.
 - pruning, cane v. spur, Nebr., 741.
 - pruning experiments, Ark., 835; Ill., 336.
 - pruning in summer, 528.
 - spraying v. dusting, Miss., 39.
 - storage studies, 141.
 - systems of training, West.Wash., 523.
 - variety tests, Miss., 38; S.C., 636; Tex., 636.
- Grapevines, annual wood of, and maturation, 123.
- Grass—
 - disease of horses and botulism, comparison, 774.
 - diseases of horses, 875.
 - ensiled, feeding value, 165.
 - ensiled Netherlands, vitamin C in, 165.
 - from pastures, composition, 131.
 - ill in lambs, 669.
 - mixture for hay, value of red clover inclusion, Ill., 328.
 - mulch v. tillage-cover crops for apples, Ohio, 40.
 - staggers, cause and therapy, 876.

Grasses—

- culture experiments, Ky., 218.
- forage, yield and composition, Vt., 252.
- Indian, and grasslands, 425.
- lawn and pasture, tests, Fla., 325.
- of Central America, 628.
- of genus *Paspalum* in North America, 131.
- of Indiana, 218.
- production tests, Alaska, 127.
- variety tests, N.Dak., 129; Tex., 627; V.I., 219.
- wheat and quack, seeds, comparison, 136.
- wild pasture, composition at successive stages, 131.
- (See also Grassland and Pastures.)

Grasshoppers—

- activities, 647.
- control, 544.
- effect of temperature and moisture, Mont., 755.
- in north central Montana, 155.

Grassland—

- management, intensive system, 131.
- problems, 424, 425.
- (See also Grasses and Pastures.)

Gravel and sand industry, simplification of sizes in, U.S.D.A., 882.

Grazing areas in Alaska, surveys, Alaska, 179.

(See also Range.)

Green manure—

- bacteriological effects, Miss., 506.
- crops, diseases of unknown nature, 47, 236.
- crops, tests, Fla., 325.
- effect on carbon and nitrogen in soil, 816.
- effect on soil moisture, 815.
- plants of Dutch East Indies, insect enemies, 450.
- tests, V.I., 219.

Green manuring—

- studies, 212; Fla., 317.
- value, Calif., 727.

Greenhouse leaf tyer, control, Ill., 353.

Grouse locust, parthenogenesis and inheritance of color patterns, 422.

Grouse, ruffed, flagellates, classification, 671.

Growth—

- and nutrition, physical measures of, 687.
- factor, new, for rats, 589.
- in infancy, composition of, 393.
- in rabbits, hereditary size limitation, 216.
- of parts, relation to whole in animals, 822.
- studies with liver, 493.

Grubs, root-eating scarabaeid, in cane fields, control, 646.

Gryllotalpa gryllotalpa, notes, 154.

Guanidine in blood of cow in milk fever, 264.

Guinea grass, feeding value, V.I., 220.

Guinea pigs—

- female, artificial insemination, 125.
- rosettes in, genetics, 725.

Gullies in soils, control, Mo., 78.

Gymnosporangium photinae, notes, 145.*Gypona octolineata striata*, life history notes, 853.*Hadrobracon juglandis*, effect of X-rays, 457.*Haemonchus contortus*, studies, 378.

Halogens in organic compounds, determination, 608.

Halticus tibialis, notes, 450.

Harmattan and atmospheric humidity, 713.

Harmolita eremitus in lower Volga District, 243.

Hay—

- crop combinations for, Alaska, 127.
- curing, artificial, 79.
- effect of lime, S.C., 508.
- feeding value, 165.
- grinding, effect on digestibility, Pa., 370.
- hoists, electric, Oreg., 79.
- of Quebec, calcium and phosphorus in, 549.
- spontaneous combustion, cause, U.S. D.A., 176.
- stackers, use, U.S.D.A., 674.
- (See also Grasses, Alfalfa, Timothy, etc.)

Hazel weevil, notes, 852.

Health relation to clothing, bibliography, U.S.D.A., 695.

Heart—

- beat of chick embryo, 460.
- beat, periodic reversal in moths, 648.
- block in rice-fed pigeons, 596.

Heat—

- insulators, 675.
- production, basal, measurement, 597.
- production of albino rats, 192.

Heating—

- domestic, with oil burner, U.S.D.A., 97.
- house, effect of types of radiators, 884.
- house, with radiators equipped with enclosures and shields, 674.
- of soil by electricity, 672.
- plants, domestic, smokeless combustion in, 275.

Heliocitin, antirachitic action of, 396.

Heliothrips unipuncta. (See Army worm.)*Heliothis obsoleta*. (See Bollworm and Corn earworm.)*Helix aspersa* in citrus orchards, 448.

Helminth proteins, hypersensitiveness to, 875.

Helminthosporium sp., notes, Ark., 845.

Hemispherical scale, notes, 542.

Hemlock, western, properties relation to uses, U.S.D.A., 641.

Hemoglobin—

- building, utilization of iron in, effect of manganese and copper, 391.

Hemoglobin—Continued.

- maintenance on synthetic diets, 190.
- regeneration, 598.
- synthesis in chicks, relation of iron and copper to, 688.

Hemoglobins in chironomid larvae, propagation and significance, 241.**Hemoglobinuria—**

- bacillary, immunization of cattle against, 284.
- bovine bacillary, 668.

Hemorrhagic disease in cattle, Nev., 76.**Hemp stalks, physical and chemical characteristics, 530.****Hens, laying—**

- all-mash ration for, Ky., 256.
- calcium metabolism in, Ky., 68.
- feeding experiments, Ky., 368.
- protein sources for, Miss., 68.
- reproductive organs, pH of, 125.
- sunlight requirements, N.Y.State, 68.
- (See also Egg production.)

Herediscope demonstration of dairy cattle improvements, 823.**Heredity—**

- and natural resistance to disease, 322.
- and sex, 624.
- correlated, in wheat crosses, 27.
- human, studies in, 514.
- in chicks, Pa., 368.
- in crossbred cattle, Ill., 323.
- in goats, 20.
- of barley leaf rust resistance, 845.
- of breadth and height of nose, 824.
- of color. (See Color inheritance.)
- of cryptorchism in goats, Tex., 625.
- of double loin character in cattle, 824.
- of lintless cotton, 124.
- of polymastia in cattle, 823.
- of resistance to *Danys bacillus*, 514.
- of size in rabbits, 823.
- of size limitation, 216, 822.
- of skull defect in swine, 625.
- of thyroid size, 823.
- of twisted nose in mice, 824.
- of wheat stinking smut resistance, 846.

Hessian fly—

- control, Ind., 656.
- control in United States, 647.
- in Pennsylvania, 249.

Heterodera—

- caconema radiicola*, notes, 145.
- radicola*, control, Fla., 344.

Heterosis in rats, 622.**Heterothallism in cereal rusts, cytological studies, Calif., 745.****Hevea brasiliensis. (See Rubber.)****Hexachlorethane, anthelmintic value, 877.****Hexameris sp., parasite of onion maggot, Ill., 353.****Hibiscus tiliaceus, annual partial wilting in, 52.****Hickory—**

- bark beetle outbreaks, weather as factor, 158.
- nut weevil, studies, Miss., 53.

Hides infected with anthrax, disinfection, 167.**Hierozestis subcervinella on banana in Canary Islands, 357.****Highways. (See Roads.)****Hippelates pusio, studies, Calif., 751.****Hippuric acid elimination in urine of cattle, 264.****Hitches, knots, and splices, strength tests, 174.****Hog cholera—**

- bacillus, dissociation, 170, 773.
- blood, examination, 773.
- immunization of young pigs against, 260, 470; Ill., 375.
- studies, 669.
- variations in plasma cholesterol and cholesterol ester content in, 878.

Hogs. (See Pigs.)**Holcocera pulvrea, notes, 542.****Holly propagation, 433.****Home economics—**

- basis for extension programs in, U.S. D.A., 90.
- classes, teaching social and family relations in, 89.
- education, developments and trends, 186.
- education, training supervisors, 391.
- research, progress and problems in, 88.
- status of Fernald research in, 89.
- undergraduate work, 89.
- vocational education in, under George Reed Act, 89.

Home grounds, planning, planting, and care, Miss., 143.**Home living problems, textbook, 487.****Homemaking, use of time in, R.I., 598; Wash.Col., 598.****Homoptera, Porto Rican, 854.****Homotoma fleus, notes, 154.****Honey—**

- and honeycomb, vitamins in, 93.
- diastatic activity, Calif., 753.
- use in ice cream, Ill., 372.
- yield, factors affecting, 159.

Hookworms in dogs, 265.**Hop downy mildew, notes, 49, 532.****Hop virus diseases, transmission, 536.****Hormodendrum—**

- cladosporioides*, notes, 538.
- microsporium* n.sp., notes, 538.

Hormone—

- from urine of pregnant women, effect on immature ovaries, 826.
- gonad-stimulating, in the pituitary and stage of oestrous cycle, correlation, 324.
- gonad-stimulating, of anterior pituitary and ovarian grafts, 217.
- of anterior hypophysis for diagnosing pregnancy, Calif., 726.
- ovarian, recovery from urine of injected monkeys, 325.

Hormonema dematioides n.g. and n.sp., notes, 538.

Hormones—

corpus luteum and follicular, interaction, 127.

oestrum-producing and oestrum-inhibiting, in ovary of cow, 516.

Horse hours and equipment cost on Missouri farms, Mo., 82.

Horses—

Bohemian, fossil remains, 515.

breeding, health control of, 260.

farm work, cost of keeping, Mo., 82.

feeding and breeding experiments, Can., 549.

inherited coat color, 514, 620.

new hereditary factor in, 216.

outlook for 1930, Okla., 784.

production, effect of motorization, 277.

teams, pulling power, Ill., 381.

tractors, and farm equipment, Iowa, 83.

variations in, 421.

Horticultural Congress, International, notes, 500.

House flies, poison for, 241.

Household insects, control, 355.

Humidity—

atmospheric and harmattan, 713.

relation to forest fires, 313.

Hyalopterus arundinis. (See Plum aphid, mealy.)

Hybrid vigor in poultry, 215.

Hybrid vigor in rats, 622.

Hydrocyanic acid—

evolution from calcium cyanide, 448.

for insect pests, 449.

Hydrogen cyanide fumigation, covers for confining gas, Tex., 652.

Hydrogen-ion—

apparatus, portable, description, 11.

determination and importance in chemistry, treatise, 707.

determination in solid media, methods, Pa., 311.

determination with glass electrode, potentiometer for, 607.

Hydrophobia. (See Rabies.)

Hylastes spp., notes, 547.

Hylemyia—

antiqua, life history and control, 858.

antiqua, studies, 242.

cilicrura. (See Seedcorn maggot.)

Hylobius piceus, notes, 547.

Hylotrupes bajulus, outbreak, 450.

Hylurgus ligniperda, notes, 547.

Hymenoptera, parasitic, value, 859.

Hypervitaminosis—

and vitamin balance, 196.

in rats, experimental, 96.

Hypodactylism, congenital, new type, 215.

Hypoderma—

bovis. (See Ox warble flies.)

rossi in goats, 773.

Hyponomeuta—

malinellus, biology, 542.

spp., notes, 852.

Hypophyseal tissue implants, effect on immature ovaries, 826.

Hypophyses, anterior—

effect on immature ovaries, 825.

hormone content, sex difference, 826.

Italia leucospoides, parasite of *Sirex*, 359.

Ice cream—

dehydrated egg products in, 465.

frozen without stirring, U.S.D.A., 288.

industry, use of honey in, Ill., 372.

irradiated, antirachitic value, 95.

manufacture, 465; N.Y.Cornell, 782; Pa., 372.

mixes, processing, Mo., 72.

nutritive value, 391.

production, sanitary requirements, 555.

use of egg yolk in, 166.

whipping properties, effect of butter, 465.

Ichneumon flies, new species, 860.

Ichneumonidae—

hymenopterous parasites, 542.

notes, 548.

Icterohemoglobinuria—

in cattle, anaerobe isolated from, 261.

replacement of term, 264.

Ilex seeds, germination, 640.

Illinoia pisi. (See Pea aphid.)

Illinois Station, report, 399.

Illinois University, notes, 697.

Immigration, Mexican, papers on, 580.

Immunization. (See *spectio diseases*.)

Inanition, effects on growth and structure, 490.

Inbreeding and malignancy, 216.

Incubation—

artificial, at high altitudes, Wyo., 868.

of chicks, abnormalities, heat as factor, 460.

research, N.Y.Cornell, 765.

Incubators—

disinfection during hatching, 173.

forced-draft, fumigation, 472.

Index numbers of production, prices, and income, Ohio, 887, 677.

Indiana Station, Moses Fell Annex, report, 99.

Industrial arts education, 186.

Infant—

foods, proprietary, bacteria in, 392.

mortality, effect of sex-linked factors, 725.

Infants—

breast-fed, supplying vitamin B to, 692.

feeding, soybean preparation for, 584.

growth in, studies, 393.

growth rate, relation to diet, 394.

insensible perspiration in, 92.

vitamin B requirements, 397.

(See also Children.)

Influenza of cattle, 772.

Inheritance. (See Heredity.)

Insect—

- attack, relation to internal condition of host plant, 245.
- collections in museum of California Academy of Sciences, 649.
- fauna of thermal springs, 647.
- nutrition and metabolism, 653.
- outbreaks, conditions governing, 449.
- pests, control operations, 449.
- pests, control with naphthalene, 448.
- pests, foreign, procession of, 243.
- pests, natural control, 448, 449.
- pests, outbreaks in German forests, 450.
- pests under biological control in Hawaii, 648.
- taxonomy, papers on, 646.
- wings, structure, 649.
- world, exploring wonders of, 151.

Insecticide-fungicide combinations, new, 646.

Insecticides—

- analyses, N.J., 524.
 - chemical composition, Oreg., 524.
 - compatibilities, 653.
 - patent, 241.
 - preparation and use, Oreg., 839.
 - recent advances in, 242.
 - stomach, 649.
 - stomach poison, estimating toxicity, 648.
- (See also *Sprays and specific forms.*)

Insects—

- abundance, paper on, 241.
- affecting coffee, 542.
- affecting man and animals in Colombia, 542.
- and animal pests in Hawaii, 542.
- and pests of Queensland fruits and vegetables, 154.
- as transmitters of plant diseases, 450.
- attacking unbarked logs, protection from, U.S.D.A., 55.
- biological control, multiple parasitism, 851.
- biological control, parasites v. predators, 851.
- caging on host plants, 242.
- collected in trap baits, 654.
- control, chemical methods, 649.
- economic, control, 241.
- economic, control in California, 448.
- economic, in Russia, 541.
- effect of weather and climate, 611, 613.
- for study of agriculture, collection and preservation, U.S.D.A., 54.
- forest. (*See Forest insects.*)
- garden. (*See Garden insects.*)
- heat resistance, Mo., 54.
- inbreeding, adaptations preventing, 649.
- injurious—
 - and life zones in Russia, 649.
 - destruction before sowing sugar beets, 649.
 - in Bulgaria, 649.

Insects—Continued.

injurious—continued.

- in Canada, 541.
 - in Lower Rio Grande Valley, 653.
 - in Montreal district, 242.
 - in Mysore, 542.
 - in Rhodesia, 243.
 - in Russia, control policy, 650.
 - in Scotland, 242.
 - in Sierra Leone, 542.
 - in Spain, 852.
 - to crops. (*See special crops.*)
 - of certain soil types at Aberystwyth, 55.
 - of field crops, methods of study, 647.
 - of India, list of publications, 852.
 - of Indiana, 449.
 - of North America, effect of geographical distribution, 648.
 - of Norway, handbook, 242.
 - of Porto Rico and Virgin Islands, 548.
 - of Samoa, 852.
 - of stored grain and flour mills, control, 647.
 - of the Sudan, 852.
 - of the upper air, 649.
 - of trout streams in Yellowstone Park, food, 853.
 - of Union of South Africa, 852.
 - polyembryony in, 640.
 - polyhedral diseases of, 543.
 - postembryonic development, 856.
 - relation to weather and climate, 850.
 - respiration in, 151.
 - scale. (*See Scale insects.*)
 - shade tree, activity, 648.
 - species, index to literature, 648.
 - ticks, mites, and venomous animals of medical importance, treatise, 542.
 - tree defoliating, control, 649.
 - underground, problems, 647.
- (*See also Entomology.*)
- Insein Veterinary School, report, 772.
 - Institute of Plant Industry in India, editorial, 701.
 - Insulating materials, tests, 675.
 - Insulation—
 - economical thickness, 572.
 - of storage houses, Pa., 81.
 - Insulin, rôle in carbohydrate metabolism, 595.
 - Inter-American Conference on Agriculture, Forestry, and Animal Industry, notes, 400.
 - International—
 - agricultural statistics, terminology and bases for, 582.
 - Congress of Agriculture, papers of, 276.
 - Congress of Entomology, proceedings, 646.
 - Congress of Soil Science, notes, 300.
 - Country Life Commission, report, 486.
 - Horticultural Congress, notes, 500.
 - yearbook of agricultural statistics, 582.
 - Zoological Congress, papers at, 241.
 - Intersexuality, mammalian, new type, 30.

- Intestinal—
putrefaction, Bergeim test for, 298.
tracts of rachitic rats, motility, 298.
- Iodine—
distribution, potato as index, 898.
fertilizing value, S.C., 615.
in plants, 509.
in thyroid glands of sheep, seasonal variation, 254.
survey of Nebraska, 191.
traces, determination, 807.
use in veterinary practice, 770.
vermicide action, 173.
- Iowa College, notes, 697.
Iowa Station, notes, 697.
Ipsobracon granadensis, notes, 154.
- Iris—
borer, natural enemies, 856.
culture experiments, S.C., 636.
hybrids, cytological study, 215.
of southern California, 143.
stem nematode affecting, West.Wash., 582.
- Iron—
and aluminum, effect on mortar strength, 271.
balance in plant metabolism, 618.
cast—
corrosion, 881.
elastic properties, 880.
fatigue properties, 880.
heat treatment, 882.
impact testing, 881.
machineability, 881.
physical properties, factors affecting, 880.
plain and alloy, static strength, 880.
wear testing, 881.
effect on anemia of rice disease, 596.
in eggs, effect of hens' diet, 789.
in nutrition, 190, 688.
in vegetable tissues, Miss., 111.
supplements for pigs, effect on blood, Ill., 365.
- Irradiation, effect on foot-and-mouth disease virus, 688.
(See also Ultra-violet.)
- Irrigation—
effect on rice soils, Ark., 811.
farming, costs, Colo., 281.
pipes, studies, U.S.D.A., 778.
project, Salt River Valley, studies, 282.
water, depth for lowland rice, 474.
water, units of measurement and application, Wash.Col., 271.
(See also special crops.)
- Isoagglutinins in blood of cattle, papers on, 667.
Isoergosterol, heat of combustion, 698.
Isospora lacazei affecting sparrows, 267.
- Japanese beetle—
control by soil treatment, 157.
control with soaps, 656.
new nematode parasite of, 861.
- Japanese beetle—Continued.
quarantine, Conn.State, 599.
status and control, 648.
- Japygidae, postembryonal development, 650.
- Jays and crows, studies, 240.
- Jerusalem-artichokes—
chemical composition, 330.
culture experiments, 632; Alaska, 137.
drying, 228.
- Jewish cooperative movement in Palestine, 486.
- John's disease—
in dairy herd, control, Miss., 170.
Johnin v. avian tuberculin as diagnostic agent, 260.
studies, 875.
- Johnin v. avian tuberculin as diagnostic agent for John's disease, 260.
- Johnson grass—
for hay and pasturage, U.S.D.A., 35.
hay v. timothy hay for horses and mules, Ala., 764.
- Jujubes—
culture experiments, Tex., 637.
mineral content, 584.
- Juniper aphid, new, from Utah, 155.
- Jute, growth and manufacture, 695.
- Kafir plants, tenuous, 513.
- Kale—
fertilizer experiments, West.Wash., 508.
Jersey, white flowered plants, 323.
vitamins in, Ky., 293.
- Kamala, vermicide action, 173.
- Kangaroos, Streptothrix disease in, 107.
- Kansas College, notes, 698.
- Kansas Station, notes, 698.
- Kansas Station, publications, 795.
- Kentucky Station, report, 299.
- Kerosene as medicine, danger, 467.
- Kidney—
aluminum in, 586.
worm of swine, life history, 774.
worm of swine, studies, Fla., 374; P.R., 771.
- Kidneys, fatty degeneration in dogs, 695.
- Kidneys, hypertrophy, of rats on high protein diets, 493.
- Killifish hybrids, intergeneric, genes and sex factors in, 215.
- Knapweed, Russian, characteristics and control, Colo., 37.
- Knots, hitches, and splices, strength tests, 174.
- Kohlrabi, culture experiments, P.R., 737.
- Kudzu, effect of cutting, 520.
- Labia* sp., economic value, 546.
- Labor—
and capital, organized, and unorganized agriculture, 88.
use in German farm operations, 277.
(See also Agricultural labor.)
- Lac—
culture in India, 542.
insect, life history, 854.
insects, chalcid parasites, 359.

Lactation, vitamin B requirements for, 895.

Lactobacillus spp. in spoiled tomato products, N.Y.State, 9.

Lactose—

content of milk, studies, Calif., 768.
effect on anemia of rice disease, 596.
ingestion, results, 890.

Lamb—

diseases, discussion, Mont., 260.
dysentery, summary, 875.
slaughtering and cutting, Utah, 549.

Lambs—

anaerobic infections in, 669.
cull, finishing, Ohio, 63.
fattening methods, Ill., 364.
feeder types, Pa., 365.
feeding experiments, Calif., 760; Ill., 364; N.Mex., 761; Ohio, 63.
improvement in range flocks, Nev., 62.
lameness in, 470.
metabolism studies, 657.
production and feeding, 459.
production, cross-breeding experiment, 459.
quintuplet, 29.
ram, sterilizing, 865.
range, feeding and finishing, Nev., 62.
worm-infested, effect of treatments, Ill., 375.
(See also Sheep.)

Lambs' tails, toxicity, 558.

Lamprosema indicata, life history notes, 545.

Land—

credit. (See Agricultural credit.)
Division of Great Britain Ministry of Agriculture, report, 283.
economic survey of Minnesota, 698.
grant colleges. (See Agricultural colleges.)
holdings, large, operation in Ohio, 573.
policy relation to future population, 180.
utilization, research in, 573.

Lands—

cut-over. (See Cut-over lands.)
forest. (See Forest lands.)
swamp. (See Swamp.)

Landscape gardening, Miss., 143.

Lantana camara feeding tests, 538.

Lantana, feeding experiments, 467.

Lophygma frugiperda. (See Army worm, fall.)

Larch—

canker, studies, 149, 538.
sawfly and forestry, 648.
sawfly as indicator of mouse abundance, 251.

Lastoderma serricornis. (See Tobacco beetle.)

Laspeyresia—

caryana, studies, Miss., 53.
molestis. (See Peach moth, oriental.)

Laundering—

effect on wearing quality of cotton fabrics, Mo., 97.
studies, artificial soiling of fabrics, 398.

Laundry methods, effect on unweighted and weighted silk, 794.

Lawns, preparation and care, Ohio, 45.

Lead arsenate—

effect on poultry, 633.
substitutes for, 241; Ill., 353.
value as spray, Mo., 40.

Leaf acidity of wheat, relation to vegetative vigor, 24.

Leaf litter on annually burned areas, moisture absorption, U.S.D.A., 843.

Leafhopper—

blunt-nosed, relation to cranberry false blossom, N.J., 756.
parasite, notes, 457.

Leafhoppers—

in New Jersey cranberry bogs, life history notes, 853.
injurious to clover and alfalfa, Ky., 355.

(See also special hosts.)

League of Nations, economic consultative committee, notes presented to, 180.

Leaves—

green, vitamin A in, 206.
wilting, starch exhaustion in, 25.

Lecanium robiniarum and corn borer, biological parallel, 648.

Lecanium, sex determination in, 646.

Leeks, varieties, N.Y.State, 431.

Legume—

bacteria, supplementing, value, 628.
hay, feeding value, Ark., 866.
hays for dairy heifers, Ark., 869.
pasture for pigs, quantity of feed and proteins for, Ohio, 763.
seeds, certification in Germany, 220.
seeds, stored, acidity changes in, 431.

Legumelin, physicochemical properties, 202.

Legumes—

culture, 220.
culture experiments, Ark., 828.
culture under dry land conditions, N. Mex., 32.

for nematode control in pineapple fields, Hawaii Pineapple Cannery, 445.

inoculants, sale, State laws concerning, N.J., 523.

inoculation, rôle of calcium in, 518.

inoculation, status, N.Y.State, 731.

(See also Nodule bacteria.)

production tests, Alaska, 127.

root tubercles, relation to immunity and morphology, 821.

value to succeeding crops, Ark., 816.
variety tests, Ark., 828; Ill., 328; S.C., 625; Tex., 627.

winter, tests, Fla., 325; Miss., 31, 128.
(See also Green manure and Alfalfa, Clover, etc.)

- Lemon**—
 juice, vitamin C concentrates from, preparation and properties, 501.
 juice, vitamin C in, 504.
 juice, vitamin C in, stability, 803.
 red blotch, simulation, Calif., 744.
 trees, effect of boron, 819.
- Lemons**—
 culture experiments, Calif., 734.
 effect of boron, 142.
- Lenzites sepiaria**, notes, U.S.D.A., 239.
- Leopard moth**, status, 647.
- Lepidoptera**—
 female reproductive organs, 450.
 number of eggs, effect of temperature, 647.
 nutrition physiology, 450.
- Leptinotarsa decemlineata**. (See Potato beetle, Colorado.)
- Leptoglossus**—
 spp., notes, 241.
 zonatus, notes, 544.
- Leptographium lundbergii** n.g. and n.sp., notes, 538.
- Leptospira icterohaemorrhagiae** in Oxford rats, 240.
- Lepus americanus**, color changes in, 514.
- Lespedeza**—
 culture experiments, Ky., 218; P.R., 731.
 fertilizer experiments, Miss., 128.
- Lettuce**—
 breeding, Pa., 339.
 culture experiments, P.R., 737.
 downy mildew, sulfur as fungicide, Calif., 745.
 fertilizer experiments, West.Wash., 523.
 green and white, vitamin A in, 397.
 leaves, necrotic tissue in, West.Wash., 532.
 production, U.S.D.A., 340.
 tissues, green, nitrate in, 432.
 varieties, Pa., 339.
 vitamin A in, relation to soil fertility, 193.
- Leucocytes**, number in blood of birds, 564.
- Leuconostoc pleofructi** in spoiled tomato products, N.Y.State, 9.
- Leucophaea coffeella**, notes, 542.
- Life and reproduction**, treatise, 515.
- Life, mutation, and evolution**, physico-chemical aspects, 420.
- Light**—
 artificial, effect on egg production of pullets, Miss., 67.
 artificial, effect on winter egg production, Mo., 68.
 daily length, effect on plant growth, 524.
 (See also Sunlight.)
- Lights**, all-night, for winter egg production, Ohio, 389.
- Ligyrus** beetle grubs, destruction by robber fly, 250.
- Lilac hybrids**, precocious, 529.
- Lilies of southern California**, 143.
- Lilium formosum** mosaic, notes, 145.
- Lima beans**. (See Beans, Lima.)
- Lime**—
 chlorinated, new type, 609.
 fertilizing value, Pa., 318.
 hydrated, as control for oriental fruit moth, 248.
 nitrogen. (See Calcium cyanamide.)
 requirements of soils. (See Soils.)
 (See also Calcium and Liming.)
- Limestone**—
 dolomitic, lime-magnesia ratios in, 818.
 use, Ill., 315.
 value in cattle ration, Kans., 363.
- Lime-sulfur**—
 dilution, sulfide sulfur content as basis, Colo., 55.
 in steel drums, storage, 653.
- Liming materials**, choice of, Ohio, 22.
- Limnea brazieri**, bionomics, 503.
- Linkage**—
 in silkworms, 620.
 intensities, calculating, formulae and tables, 623.
 of characters albinism and shaker in mice, 215.
- Linseed**—
 meal, effect on feces of dairy cattle, 554.
 meal, feeding value, Ohio, 65.
 oil, ovidal action, 241.
 oil, tariff data, 576.
- Lipase activity**, acceleration by vitamin A, 587.
- Litrodotes praemorsa**, studies, 158.
- Lithium compounds**, effect on chick embryo development, 460.
- Liver**—
 aluminum in, 586.
 cirrhosis in horses, 876.
 diets, specific effect on growth and fat deposition, 760.
 effect on anemia of rice disease, 596.
 extract preparation for pernicious anemia, 191.
 fatty degeneration in dogs, 695.
 fluke infestation of sheep in Australia, 563.
 fluke, intermediate host, P.R., 771.
 flukes, control, 467.
 growth factors in, 493.
 rot in sheep, studies, 875.
- Livestock**—
 cheaper winter food for, 862.
 diseases. (See Animal diseases.)
 Exposition, prize winners, breeding and fitting for, N.Dak., 760.
 farming, fertility pkns for, Ill., 315.
 feeding, treatise, 160.
 industry, development, 862.
 industry in Scotland, changes in, 180.
 insurance, development and status, 183.
 losses in shipping, Ohio, 182.
 marketing in Ohio, rôle of trucks in, 183.

Livestock—Continued.

- mineral nutrition, rôle of pasture in, 131.
- poisoning by arrow grass, U.S.D.A., 74.
- poisoning by ragwort, 876.
- poisoning by sleepy grass, U.S.D.A., 74.
(See also Plants, poisonous, and specific plants.)
- possibilities in southeastern Coastal Plain, U.S.D.A., 170.
- pure breed, introduction into Philippines, 620.
- review for 1928, U.S.D.A., 85.
- statistics. (See Agricultural statistics.)
- (See also Animals, Mammals, Cattle, Sheep, etc.)
- Living. standard of. (See Standards)
- Lazophaga variabilis*, notes, U.S.D.A., 357.
- Locust, black, scale and corn borer, biological parallel, 648.
- Locust subcommittee, reports, 451.
- Locusts—
 - control, 56.
 - in Soviet Russia, 649.
 - invasion of Palestine, 853.
- Log cabins, protection from injurious insects, U.S.D.A., 55.
- Loganberries—
 - seedling, studies, Can., 638.
 - variety tests, Tex., 636.
- Loin disease of cattle, studies, Tex., 665.
- Lonchaea occidentalis*, notes, 455.
- Lucern. (See Alfalfa.)
- Luotlia sericeata*, hibernation, 157.
- Lygus apicalis*, effect on cotton plant, 655.
- Lygus pratensis*. (See Tarnished plant bug.)
- Lymnaea cubensis* as host of liver fluke, P.R., 771.
- Lymphadenitis—
 - caseous, in sheep, 467, 669.
 - caseous, paper on, 167.
- Lymphangitis—
 - epizootic, sequela of treatment, 774.
 - of acid-fast skin infections in cattle, Calif., 770.
- Lynchia maura*, notes, S.C., 650.
- Lyperosia exigua*—
 - anthrax transmission experiments, 168
 - new pest in Australia, 858.
- Lysimeter experiments, P.R., 719.
- Macadamia nut in Hawaii, Hawaii, 529.
- Machinery. (See Agricultural machinery.)
- Macrocentrus ancyra*—
 - notes, N.Y.State, 449; S.C., 651.
 - transferring to oriental peach moth, 655.
- Macronoctua onusta*. (See Iris borer.)
- Macrophoma phaseoli*, notes, Miss., 145.
- Macrostagon cucullata*, economic value, 546.
- Macrosiphum solanifolia*, transmission of tobacco mosaic by, 854.
- Macrosporium cucumerinum*, notes, 145.
- Macrosporium* sp., notes, Mo., 46.

Magnesium—

- and calcium, absorbed and exchangeable, in soils, 818.
- and calcium, relations in animals, 458.
- arsenate, value as spray, Mo., 40.
- availability and base exchange in rice soil, Ark., 811.
- carbonate, effect on anemia of rice disease, 596.
- compounds, effect on chick embryo development, 460.
- deficiency, cause of corn chlorosis, 441.
- deficiency, effect on apple trees, 839.
- in avocado leaves, Calif., 745.
- in pea plants, variations, 415.
- microanalysis, 167.
- requirements of tobacco, 721.
- rôle in axing of plants, Vt., 319.
- rôle in plant growth, Vt., 347.
- Maine—
 - Station, abstracts of papers, finances, index, etc., 696.
 - University, notes, 600, 698.
- Maize. (See Corn.)
- Malaria—
 - carriers, control, 57.
 - carrying mosquitoes, geographical distribution, 545.
 - control in Porto Rico, 58.
 - in Algeria, control, 157.
 - parasites, development in mosquitoes, 546.
 - (See also Mosquitoes and Anopheles.)
- Malta fever. (See Undulant fever.)
- Mammals—
 - anatomy and classification, treatise, 446.
 - female sexual cycle, 517.
 - (See also Animals and specific kinds.)
- Mammary glands of cows, anatomy, Mo., 29.
- Mammitis. (See Mastitis.)
- Man, absorption and excretion of aluminum in, 585.
- Man, nasal forms in, hereditary factors in, 824.
- Manganese—
 - determination in presence of silica, 203.
 - effect on plants and animals, Ky., 203.
 - in normal nutrition, 555.
 - storage in body, effect on hemoglobin building, 391.
 - toxicity in tobacco, 620.
- Mange in camels, treatment, 377.
- Mangels—
 - v. dried sugar beet pulp for dairy cows, 664.
 - variety tests, N.Dak., 129.
- Mangoes—
 - Alphonso, pollination, 231.
 - culture in Hawaii, Hawaii, 231.
- Mankind and forests, treatise, 843.
- Mannitol, effect on growth of microorganisms, 94.

Manure—

- artificial, from straw, Mo., 17; N.Y. State 21.
- composting with sulfur and rock phosphate, Ga., 21.
- decomposition, chemical and microbiological principles, 814.
- use under semiarid conditions, Okla. Panhandle, 211.
- value per ton on poor and good soil, Ill., 315.

Manures, synthetic, for mushroom growing, 138.

Maple—

- leaf stalk borer, notes, 242.
- trees, sugar, rest period, shortening, 618.

Margarine—

- vitamin A in, 111.
- vitaminized, dietetic value, 895.

Margarodes polonicus, morphology and biology, 241.

Margaropus annulatus. (See Cattle ticks.)

Market—

- gardens. (See Truck crops.)
- reports, U.S.D.A., 85, 286, 388, 66, 587.

Marketing—

- and marketing machinery, treatise, 281.
- cooperative, in Scottish agriculture, developments, 885.
- cooperative, papers on, 681.
- cooperative, treatise, 187.
- credit and reserves, 632.
- survey of Union County, Oregon, 181.
- treatise, 284.
- (See also special products.)

Markets—

- farmer-owned, in Ohio, Ohio, 485.
- for agricultural products, widening through research, 88.

Marmite, vitamin B factors in, 589.

Marsculia dilativentris, notes, 450.

Martynia, varieties, N.Y.State, 481.

Masicera senilis, notes, 856.

Massachusetts—

- College, notes, 498, 698.
- Station, notes, 498, 698.

Mastitis—

- bacteriology, 668.
- studies, 875; Conn.Storrs, 376.

Matthiola reverting forms, chromosome constitution, Calif., 723.

May beetles—

- on pecan, Miss., 152.
- tabular list, 355.

May, D. W., retirement from Porto Rico Station, editorial, 601.

Mayetiola destructor. (See Hessian fly.)

Mealy plum aphid, life history and control, Calif., 752.

Mealybug—

- citrophilus, importation of natural enemies of, 547.
- citrophilus, in California, Australian enemies imported for, 57.

Mealybug—Continued.

- citrophilus, new natural enemies, Calif., 751.
- long-tailed, fumigation with chloropicrin, 156.
- on grapes, 246.

Mealybugs—

- control by oil sprays, Calif., 751.
- water washing for, Calif., 751.
- (See also specific host plants.)

Meat—

- animals, conservation of wastes from small-scale slaughter, U.S.D.A., 121.
- diet, exclusive, effect on carbohydrate tolerance of two men, 491.
- diet, exclusive, effect on chemical constituents of blood, 491.
- extracts, changes produced by *Staphylococcus aureus*, 110.
- proteins, studies, Mo., 9.
- quality, factors affecting, Ill., 363.
- report, 772.
- scrap v. cottonseed meal for poultry, S.C., 661.
- specific effect on growth and fat deposition, 760.
- trade, treatise, 658.
- (See also Beef, Pork, etc.)

Media. (See Culture media.)

Mediterranean fever. (See Undulant fever.)

Melanogaster ampelophila. (See Pomace fly.)

Melanoplus mexicanus mexicanus, effects of temperature and moisture, Mont., 755.

Melanose, spraying experiments, Fla., 344.

Melanotus sp., parasite of, 241.

Meligethes aeneus, biology, 243.

Me'lons, culture experiments, P.R., 737.

Menhaden fish oil as spray sticker and spreader, Del., 753.

Meningoencephalomyelitis of swine, 265.

Menstrual cycle in monkeys, fertile period, 726.

Menstruation, effect on gaseous metabolism, 290.

Mental defectives, order of birth of, 625.

Mercuric chloride test for trypanosomiasis in camels, 263.

(See also Corrosive sublimate.)

Mercury compounds, organic, value against scab, 848.

Metabolism—

- basal, during menstrual cycle, 290.
 - basal, of children, 687.
 - basal, of omnivorous and vegetarian rats, 91.
 - basal, of overweight children, 188.
 - basal, of underweight children, 189.
 - effect of air and sun baths, 290.
 - in chickens, Ky., 255.
 - of dogs and pigeons, apparatus and technic for study, 597.
 - of undernourished children, 490.
- Metals, resistance to abrasive action of plastic clay, 568.

Metaphen for treatment of bacteremia and septicemia, 560.

Metatromyglus spp. development in intermediate hosts, 503.

Meteorological—

observations, Alaska, 115; Ky., 299; Mass., 115, 209, 610, 889; Me., 610; Mont., 209; N.Dak., 199; Pa., 314; U.S.D.A., 15, 208, 209, 505, 610, 808; V.I., 209.

observations of southern South America, U.S.D.A., 505.

research and fruit production, 611, 612.

scheme, British agricultural, 611.

Meteorologists, Empire, conference of, 611.

Meteorology—

agricultural, relation to plant physiology, 612.

agricultural, status and outlook, 313.

papers on, 611; U.S.D.A., 16, 208, 505, 808.

(See also Climate, Rainfall, Temperature, Weather, etc.)

Mice—

destruction of larch sawfly larvae by, 251.

dwarf, studies, 323.

grasshopper, life history and habits, U.S.D.A., 446.

growth rate, innate limitations, 216.

shaker, a new mutation, 822.

twisted nose in, inheritance, 824.

vitamin B requirements, 894.

X-rayed, effects, 215.

(See also Rodents.)

Michigan College, notes, 698, 900.

Michigan Station, notes, 498, 600, 900.

Microbracon—

lenticulatus n.sp., notes, 880.

mellicor, parasite of boll weevil, U.S.D.A., 359.

serinopae, life history and habits, 457.

sp., parasite of grape berry moth, Del., 754.

Micrococcus meliensis in goats, immunization, 563.

Microgaster, revision of genus, 547.

Microgaster tibialis, laboratory breeding, 541.

Microlepidoptera, generic names, list, 454.

Microorganisms—

growth, relation to composition of medium, 94.

in soil, effect of plant growth, 415.

pathogenic, treatise, 259.

role in formation and decomposition of peat, 814.

(See also Bacteria.)

Middlings, feeding value, Ohio, 696.

Milk—

acidity, relation to freezing point, 312.

added water in, detection, 312.

analysis, refractometer in, 312.

and milk products, treatise, 463.

antineuritic properties, effect of heat, 294.

Milk—Continued.
as source of vitamin B for lactation, 896.

bacteria in, determination methods, 463.

bacterial analyses, 555.

bottles, cleaning solutions for, 873.

bottles, sterilization, 466.

business, establishing in small community, 553.

collection at country plants, N.Y.Cornell, 86.

color, relation to skin pigment, Ill., 369.

composition, effect of feeds, 664.

consumption and growth of school children, 280.

control, 555, 556.

cooling houses and insulated tanks, construction, 479.

cooling with electric brine cooler, Vt., 258.

copper in, effect of diet, 463, 892.

cost of production, Ill., 336.

cystine deficiency in, Ill., 391.

data of U. S. Tariff Commission, 482.

dried and sweetened condensed, effect on rickets, 898.

dried artificial, and nutritive equilibrium, 792.

effect of feeding soybeans, S.C., 665.

evaporated, relation to public health, 583.

fat determination in, 408.

fat dispersion and casein stability, effect of homogenization, Pa., 373.

fat globules in, size, Mo., 72.

fed rats, development, 895.

feeding in schools, Scottish, 893.

fever research, 699.

fever, status of knowledge, 876.

fever, sugar, guanidine, and cholesterol in blood, 264.

filtering on the farm, 555.

for cheese making in New Zealand, 356.

for pasteurization, improvement, 553.

freezing point, seasonal variations in, 871.

from different quarters of udder, variations in, 871.

goats', value, 459.

heated, acid production rate, 9.

high quality, production, Vt., 258.

human and cow's, effect of irradiated yeast in ration, 495.

in household refrigerator, 686.

industry, temperature instruments in, 884.

inspection, papers on, 555.

irradiated, for treatment of rickets, 594.

irradiated, v. cod-liver oil as source of vitamin D, 692.

lactose in, studies, Calif., 768.

laws, paper on, 555.

market, importance, N.Y.Cornell, 781.

Milk—Continued.

- market, studies, N.Y.State, 463.
 - marketing through ice cream, N.Y.Cornell, 782.
 - nutritive value, 583.
 - of foot-and-mouth disease affected animals, infectivity, 168.
 - pasteurization, bacteria present during, N.Y.State, 73, 373.
 - pasteurization, effect of age of bacteria, 556.
 - pasteurization, papers on, 555.
 - pasteurized, heat-resistant and heat-loving bacteria in, 555.
 - pasteurized v. unpasteurized, Ill., 372.
 - plants, city, equipment, U.S.D.A., 770.
 - plants, operations, U.S.D.A., 782.
 - powder, bacteriology, 190.
 - powdered whole irradiated, antirachitic value, 594.
 - producers, organization in Switzerland, 276.
 - production for interstate shipment, 555.
 - production records, Alaska, 165.
 - quality, improvement, 555.
 - quantity in udder at milking time, Mo., 71.
 - raw and pasteurized, creaming, N.Y.State, 769.
 - raw, production, 555.
 - receiving station operation, Vt., 284.
 - reduction test for, merit, Ill., 371.
 - refrigeration experiments, 872.
 - secretion during first pregnancy, Mo., 71.
 - secretion, effect of low-fat ration, N.Y.Cornell, 768.
 - secretion, initiation in nonpregnant heifers, Mo., 70.
 - secretion, stimulating, Mo., 71.
 - sickness, summary, U.S.D.A., 75.
 - skimmed. (*See* Skim milk.)
 - solubility of calcium phosphate in, 556.
 - sterilizing, method, N.Y.State, 373.
 - substitutes for calves, Mass., 257.
 - sugar, manufacture, N.Y.Cornell, 710.
 - supply of New York City, N.Y.Cornell, 781.
 - taste of, 872.
 - tests, methylene blue reduction v. bromthymol blue, 503.
 - viscosity, calculation, 871.
 - vitamin D in, 495.
 - waste, disposal, 555.
 - weed poisonous to sheep, 558.
 - yield and quality, factors affecting, 684, 870.
 - yield, effect of oestrus, 871.
- Milking—**
- machines, bacteriological studies, 165.
 - process, physiology, Mo., 71.
- Milkweed, propagation and food translocation in, 419.**
- Mill waste, feeding value, 255.**

Millet—

- bug, Sudan, studies, 853.
 - variety tests, N.Dak., 129.
- Millipedes, control, Pa., 353.**
- Mimicry and related problems, 649.**
- Mineral—**
- analyses of jujube, 584.
 - feeding experiment with dairy cattle, Mich., 870.
 - metabolism of cattle, 863; Vt., 370.
 - mixtures fed to chicks, value, Ill., 367.
 - nutrients, migration during growth of plants, 121.
 - nutrition of dairy cows, Mass., 663.
 - nutrition of plants, reaction of medium as factor, 820.
 - oil, effect on anemia of rice diseases, 596.
 - oil, effect on assimilation of vitamin A, Pa., 397.
 - research, recent advances in, 587.
 - salts in plants, transfer, tissues involved in, 122.
 - supplement in dairy ration, value, Pa., 370.
 - treatments of pastures, 131.
- Minerals—**
- effect on egg production and fertility, Ark., 868.
 - effect on wool yield of Angora rabbits, 462.
 - for pigs, Ohio, 66.
 - in pineapple bran, Hawaii Pineapple Cannery, 457.
- Minnesota—**
- Station, notes, 698.
 - Station, report, 696.
 - University, notes, 100, 698.
- Mint cuttings, effect of nitrates on growth, 836.**
- Minuticornis gravidis* n.g. and n.sp., description, 155.**
- Miridae feeding on cotton, effects, 655.**
- Mississippi Station, report, 99, 109.**
- Missouri—**
- Station, notes, 699, 797.
 - Station, report, 99.
 - University, notes, 699, 797.
- Mites and other animal pests of medical importance, treatise, 542.**
- Mites in rubber nurseries, control, 457.**
- Mites on citrus trees, control, 647.**
- Mites, woolly, on cotton, 548.**
- Mohair industry and Angora goats, U.S.D.A., 460.**
- Mohave Desert region of California, 474.**
- Moisture—**
- changes, effect on building materials, 672.
 - studies of combined grains, S.Dak., 779.
- Molasses—**
- beet pulp. (*See* Sugar beet pulp.)
 - cane, for poultry, 551.
 - cane, v. corn chops for milk production in Porto Rico, 165.
 - final, experiments with, 808.

- Mold and yeast counts in butter, relation to keeping quality, 464.
- Molds in bottled beverages, heat destruction, Calif., 787.
- Mole cricket, control, P.R., 751.
- Moles, trapping, 151.
- Monocosta coryli*, studies, Ark., 851.
- Monophleboids, notes, 647.
- Monosaccharids, fermentation by organisms of abortus-melitensis group, 772.
- Montana—
 College, notes, 100, 300.
 Station, notes, 100, 300.
 Station, report, 299.
- Mormoniella vitripennis*, notes, 860.
- Morphology, trend of, 510.
- Mortar strength, effect of iron and aluminum, 271.
- Mosaic—
 disease and mottling, studies, 235.
 diseases in the Canary Islands, hosts, 348.
 (See also specific host plants.)
- Mosquito—
 larvae development, effect of pH, 157.
 larvae, dusting machine for destroying, 274.
 population, daily turnover in resting places, 454.
- Mosquitoes—
 Anopheline, Nyssorhynchus group, 647.
 breeding, effect of *Ohara* spp., 249.
 control, 449; Mont., 242.
 control, aquatic plants as aids in, 857.
 control, diluents of Paris green for, 454.
 effect of color, 648.
 in China and human disease, 647.
 malarial, egg-laying capacities, 249.
 malarial, geographical distribution, 545.
 of Canadian prairies, biology, 856.
 papers on, 649, 650.
 studies, Mo., 54.
 survey in South Africa, 57.
 transmission of fowl pox by, 774.
 transmission of surra by, 454.
 (See also Anopheles, Malaria, and Yellow fever.)
- Moth borer—
 control in British Guiana, 647.
 giant, of sugarcane, 854.
- Moth eggs, method of obtaining, 241.
- Motion pictures of seeding action in seed drill, 673.
- Motor—
 trucks on New York farms, N.Y. Cornell, 781.
 trucks, rôle in livestock marketing, Ohio, 183.
 vehicles and tractors, treatise, 673.
- Mule, fertile mare, account, 29.
- Mules—
 feeding experiments, Miss., 66, 163, 550.
 outlook for 1930, Okla., 784.
- Musca domestica*. (See House flies.)
- Muscina* spp., notes, 856.
- Muscovite in soil, alteration, U.S.D.A., 120.
- Museum, regional, problems, 650.
- Museums and expert specialists, mutual relations, 647.
- Mushroom—
 insects and mites, rearing, 154.
 insects, studies, Pa., 354.
- Mushrooms—
 culture, Pa., 338.
 from artificial manure, 138.
- Muskmelon—
 downy mildew or leaf blight, infection experiments, Del., 746.
 powdery mildew, control, 145; Calif., 744.
 powdery mildew immune varieties, Calif., 735.
- Muskmelons—
 culture, Can., 638.
 fertilizer experiments, Ark., 835; Mo., 39.
 strain tests, Mo., 39.
 summary, 138.
- Muskrat industry of Maryland, 462.
- Musk rats, raising, summary, 462.
- Mustard—
 culture experiments, P.R., 737.
 greens, vitamins in, Ky., 293.
- Mutation—
 blue, in rats, 822.
 flexed tail, in house mouse, 215.
 in mice, 822.
 in tomato, 724.
 origin of dominance in response to, 512.
 recessive, in rabbit, 28.
 spontaneous, in mice, 512.
 theory and systematic biology, 821.
- Mutations—
 effects of aging of X-rayed males, 214.
 in *Drosophila*, Calif., 723.
 in oats and wheat, effect of X-rays, 510.
 limit of radiation frequency effective in, 512.
 production by X-rays, 214, 322, 725.
 studies, 28.
 visible, following radium irradiation, 214.
- Mycobacterium tuberculosis* in colostrum and milk, thermal death point, Mo., 72.
- Mycorrhizae of sugarcane, relation to root disease, 645.
- Myosphaerella fragariae*, notes, Fla., 345.
- Mylasis, cutaneous, cause and treatment, 858.
- Myiophasia nigrifrons*, notes, U.S.D.A., 251.
- Myiopsila mediatubunda*, notes, 856.
- Myllocerus maculosus*, studies, 58.
- Myzus*—
 circumflexus, notes, 854.
 persicae. (See Peach aphid, green.)
 pseudo-solani, transmission of tobacco mosaic by, 854.

- Naphthalene—
as repellent against clothes moths, 156.
for insect pests, 448.
- Napier grass, irrigation experiments, Fla., 325.
- Narcissus—
bulbs, hot water treatment, 145; West. Wash., 59.
leaf blight, notes, Mo., 46.
root rot, notes, Miss., 145.
- Nebraska—
Station, notes, 300.
University, notes, 100, 300.
- Necator suillus*, studies, P.R., 772.
- Nectar, sugar concentration in, effect of humidity, 160.
- Nectarines—
breeding, N.Y.State, 431.
new variety, N.Y.State, 431.
pollination studies, N.Y.State, 739.
- Negro children, weight, height, and age, relations, 792.
- Nemas and their larvae, studies, 560.
- Nematode disease of wheat and rye, U.S.D.A., 349.
- Nematodes—
attacking plants, 355.
control in pineapple fields, Hawaii Pineapple Cannery, 445.
new, of deer and reindeer, 269.
new parasitic, from Yucatan, 850.
of sheep, treatment, 877.
parasitic, larval migration in host, 154.
- Nematospora coryli*, notes, Calif., 744.
- Nematus erichsonii*. (See Larch sawfly.)
- Nemeritis—
canescens, parasite of Mediterranean flour moth, 154.
palmaris n.sp., description, 360.
- Neoplectana glaseri* n.g. and n.sp., description, 861.
- Neohydrophilus, morphology and geographical distribution, 650.
- Nephantis serinopa*, parasite of, life history and habits, 455, 457.
- Nettle downy mildew, notes, 532.
- Nevada Station, notes, 498, 700.
- Nevada Station, report, 99.
- New Jersey Stations, notes, 797.
- New Mexico College, notes, 700.
- New Mexico Station, notes, 700.
- New York Cornell Station—
notes, 797.
report, 796.
- New York State—
Station, notes, 400, 498, 700, 797.
Station, report, 497.
Veterinary College, report, 260.
- Newlands Field Station, work, U.S.D.A., 99.
- Nesora viridula*. (See Stinkbug, southern green.)
- Nicotiana—
effects of X-rays and radium, 215.
seeds, germinating conditions, 318.
- Nicotiana tabacum* photoperiods, significance, 320.
- Nicotine insecticidal unit charge, increasing effectiveness, 851.
- Niptus hololeucus*. (See Spider beetle, golden.)
- Nitella phauloteles*, effects on mosquito larvae, 857.
- Nitrate of potash. (See Potassium nitrate.)
- Nitrate of soda. (See Sodium nitrate.)
- Nitrates—
disappearance under timothy, N.Y.Cornell, 720.
in soil and plant as indexes of nitrogen needs, 416.
physiological reaction, 119.
production in soils, Mo., 17.
production in soils, effects of cultivation, Ark., 814.
- Nitrification studies, Tex., 614.
- Nitrite-oxidizing organism, isolation, 417.
- Nitrogen—
balance in semiarid Kansas soils, 818.
depletion in soils, Mo., 16.
fertilizers, fall applications, effect, Mo., 39.
fixation and dextrose metabolism of *Azotobacter*, N.Y.Cornell, 719.
fixation in soils, factors affecting, Del., 719.
in forage crops, effect of fertilizers, 549.
in soil, relation to green manures, 816.
in yeast, determination, 312.
industries, 212.
metabolism of dairy cattle, 870.
requirements of crops, index, 416.
treatments of pastures, 131.
utilization, relation to feed and carbohydrate supplement, 253.
- Nitrogenous fertilizers for rice, comparisons, 225.
- Nitrophos, comparison with other phosphates, 121.
- Nodule bacteria—
and soil acidity, Ill., 329.
commercial cultures, value, Ill., 329.
fermentation of glucose and xylose by, 414.
nitrogen fixation apart from host, 509.
(See also *Bacillus radicicola* and Legumes, inoculation)
- Nomenclature—
entomological, necessity of revision, 648.
principle of continuity in, 648.
systems applied to radial field of wing in Diptera, 649.
theory, 649.
zoological, future of, 649.
- North Carolina Station, notes, 798.
- North Dakota—
College, notes, 700.
Hettinger Substation, report, 199.
Langdon Substation, report, 199.

Nummularia discreta, life history, Ill., 749.
Nun moth control by airplane, 241.

Nursery—

practices, 228.
stock, insects injurious to, Mo., 54.
stocks, storage, N.Y.State, 432.

Nutrient media. (*See* Culture media.)

Nutrition—

and growth, physical measures of, 687.
energy factor in, 894.
experiments, 294.
modern conceptions, 90.
newer knowledge, treatise, 686.
of school children, Fla., 394.
plant. (*See* Plant nutrition.)
simplified, science of, treatise, 687.
(*See also* Diet.)

Nutritive equilibrium and artificial milks, 792.

Nuts—

culture, Ga.Coastal Plain, 736.
new plantings, N.Y.State, 431.

Nyssorhynchus fuliginosus, anthrax transmission experiments, 168.

Oak, cork, of Morocco, insect enemies, 401.

Oak, scrub, reforestation with, Pa., 342.

Oaks, hybrid, culture, Tex., 641.

Oat—

cross, transgressive segregation for smut susceptibility, 534.
hay, wild, feeding value, Calif., 458.
kernel, daily growth, Minn., 428.
seedling blight and foot rot disease, 534.
silage. (*See* Silage.)
smut, control, N.C., 348.
smut infection, effect of hulls, Ill., 346.
smut resistant varieties, 643.
smuts, notes, 535.
(*See also* Cereal smut.)
stem rust resistant variety, Calif., 727.

Oatmeal extract, rickets-producing factor in, 594.

Oats—

as forage crop, Mont., 219.
breeding, Ark., 828; Miss., 31; Mo., 31; N.Y.Cornell, 731; Tex., 627.
effect of lime, S.C., 508.
false wild, description and control, 655.
fertilizer experiments, Ark., 828; Fla., 325; Ga.Coastal Plain, 728; S.C., 625; West.Wash., 508.
grinding for pigs, Ohio, 65.
harvesting at different stages of maturity, 518.
harvesting with combine, Minn., 478.
improvement, Mont., 219.
in western half of United States, U.S.D.A., 632.
Indian, and error in identification, 431.
monthly prices and shipments, Iowa, 484.
rotation experiments under irrigation, U.S.D.A., 128.

Oats—Continued.

rustproof varieties, Ga.Coastal Plain, 728.
spring-sown red, production, U.S.D.A., 35.
sprouted, effect on egg production and fertility, Ark., 868.
sprouted, feeding to overcome difficult breeding, Miss., 70.
varieties, 130; Ill., 521.
varieties and strains, registration, 521.
variety date of seeding experiment, 220.
variety tests, Alaska, 127; Ark., 828; Calif. 727; Fla., 325; Ill., 327; Ind., 30; Miss., 31; Mo., 31; N.Dak., 129; S.C., 625. Tex., 626.
vitamin A in, Ill., 391.
weight per bushel and percentage of hull, 429.
yield and composition, effect of different nutrients, 121.

Odonata—

evolution of, 648.
larvae for insect phylogeny, significance, 650.
of Hawaii, origin and evolution, 650.
Oecanthus niveus. (*See* Cricket, snowy tree.)

Oestrus—

during pregnancy, 324.
of guinea pigs, effect of corpus luteum and ovarian extracts, 125.
predicting from vaginal smears, 425.
Ohio Station, bimonthly bulletin, 696.

Oil—

associations, cooperative, in Minnesota, U.S.D.A., 579.
burner for domestic heating, U.S.D.A., 97.
filters for crank cases, Calif., 777.
meal. (*See* Linseed meal.)
rape beetle, paper on, 649.
seeds, Indian, studies, 633.
sprays for citrus trees, Calif., 751.
sprays, mixing and application, 851.
sprays, petroleum, characteristics and uses, 647.
sprays, triethanolamine oleate preparation, 543.

Oils—

fatty, given parenterally, utilization 291.
for tractor lubrication, tests, Ill., 381.
lubricating, carbon deposits from, 570, 571.
miscible, and oil emulsion, relative covering power, 653.
tariff on, 888.
(*See also* Fats, Cod-Liver oil, Olive oils, etc.)

Oklahoma—

Cotton Growers Association, economic condition of members, Okla., 485.
Panhandle Station, papers from, 899.
Okra, varieties, N.Y.State, 431.

- Oleander scale—
 parasites attacking, 252.
 reproduction in, 544.
- Oleomargarine. (See Margarine.)
- Olethreutes cespitana*, studies, N.Y.Cornell, 452.
- Olurus cinereus*, notes, 153.
- Olive—
 fly, notes, 852, 858.
 oils, crude and refined, vitamin A in, 791.
- Olives, ripe, treatment, Calif., 787.
- Omphalitis in baby chicks and turkeys, 566.
- Onchocerca volvulus*, insect carrier, 649.
- Onideres cingulatus*. (See Twig girdler.)
- Onion—
 downy mildew, control, 148.
 leaf spot disease, 536.
 maggot, control, Ill., 352; N.Y.State, 449.
 maggot control in New York, 250.
 root maggot, studies, 242.
 seed germination, abnormal sprout occurring in, 136.
 smudge fungus, resistance to, cause, 237.
 thrips in Massachusetts, control, 245.
 thrips on cotton seedlings, S.C., 650.
 white rot disease, immunity trials, 536.
- Onions—
 Bermuda, culture experiments, V.I., 227.
 Bermuda, studies, Mo., 39.
 culture experiments, P.R., 737.
 culture experiments in New South Wales, 228.
 fertilizer experiments, Ill., 337.
 studies, N.Y.Cornell, 737.
 tariff data, 888.
 variety tests, Tex., 637; U.S.D.A., 40.
- Onychomys, life history and habits, U.S.D.A., 446.
- Oospora scabies*. (See Potato scab.)
- Ophiobolus* sp., notes, Ark., 845.
- Opossums, tularemia infection of man from, 561.
- Orange—
 groves, irrigation studies, Calif., 777.
 seeds, germination, temperature experiments, 231.
 tree, starch in, Calif., 734.
 trees, fumigation with chloropicrin, 156.
 trees, Washington Navel, bud selection in, U.S.D.A., 436.
 trees, Washington Navel, pruning and girdling experiments, 142.
 worm investigations, 449.
- Oranges—
 culture experiments, Calif., 734.
 effect of boron, 142.
 navel, effect of sulfur spraying, Calif., 744.
 notes, Fla., 335.
 Satsuma, effect of freezing, Miss., 38.
 shipments, Fla., 888.
- Orchard—
 heating studies, Fla., 334.
 soils, organic content, Pa., 338.
 spraying machine, cold steam, 650.
- Orchards, planning, planting, and caring for, Utah, 838.
 (See also Fruits, Apples, Peaches, etc.)
- Orchids—
 germination, nonsymbiotic, 529.
 of southern California, 143.
- Orchitis, a rare sequela to mercuric iodide treatment for lymphangitis, 774.
- Organic—
 acids in green plants, physiology, 24.
 matter, composition and decomposition in soil, 414.
- Oriental peach moth. (See Peach moth.)
- Ornamental plants, shrubs, and trees. (See Plants, Shrubs, and Trees.)
- Ornithodoros*—
rossi, notes, 377.
savignyi, notes, 172.
- Oryzaephilus surinamensis*. (See Grain beetle, saw-toothed.)
- Oryzae genera, spikelets, morphology, 428.
- Oscineilla frit* on wild grasses, 542.
- Osmotic—
 pressure measuring, new method, 805.
 pressure, use of term, 616.
 value, use of term, 616.
- Ossification, effect of light rays of certain length, 396.
- Otodectes cynotis* in ears of foxes, 471.
- Ova—
 human tubal, ovaries, and tubes, 324.
 internal migration, 325.
 of mammals, size, 827.
- Ovarian—
 extract, effect on ovariectomized monkeys, 325.
 extract, use in treatment of sterility in cattle, 562.
 regeneration, possibility of, 516.
- Ovaries—
 immature, changes in due to hypophyseal implants and hormone of pregnant women, 826.
 immature, stimulation by hypophyseal implants, 825.
 transplantation experiments, 217.
 transplantation for reproduction and for endocrine effect during pregnancy, 826.
- Ovariectomy—
 bilateral, in Leghorn fowl, effects, 423.
 complete, regeneration following, 827.
 effect on menstruation in monkeys, 423.
 effect on pregnant guinea pigs, 826.
 in Leghorn fowls, spermatogenesis following, 325.
- Ox warble flies—
 reproductive system, 455.
 studies, 857; Va., 756.

- Oxalic acid—
 in plants, 24.
 poisoning, chronic, 167.
 production by *Aspergillus niger*, 24.
- Paddy. (See Rice.)
- Paints, brushing and flowing properties, 570.
- Palm—
 bud rot disease, notes, 145.
 coconut. (See Coconut.)
 disease, notes, Calif., 744.
 leaf spot, notes, 645.
- Palmo Midds, feeding value, Ohio, 696.
- Palmites laetiventris*, notes, U.S.D.A., 654.
- Pandora moth, periodic pest of western pine forests, U.S.D.A., 356.
- Panolis flammea*, studies, 545.
- Papaya trees, longevity, V.I., 227.
- Paper mulch—
 studies with crops, Ohio, 42.
 tests, S.C., 636.
 value, N.Y.Cornell, 737.
- Paprika production in Hungary, 139.
- Parabiosis, effect on oestrous cycle, 423.
- Paradichlorobenzene—
 anthelmintic value, 877.
 around peach trees, injury, 656.
 as repellent against clothes moths, 156.
- Paralysis of fowls, studies, 172.
- Paranagrus* sp., notes, Del., 754.
- Parascaris equorum*, moisture requirements of eggs, 240.
- Parasiterola* sp., life history and habits, 455.
- Parasites—
 animal, handbook, 355.
 animal, in Porto Rico, P.R., 771.
 animal, of man and domestic animals, handbook, 240.
 entomophagous, for natural control, effect of random oviposition, 151.
 external, manual, 154.
 in digestive tract of dogs, 265.
 insect, papers on, 548.
 of Aleurodidae on citrus in Far East, 155.
 of fall army worm in Texas, U.S.D.A., 357.
 of primates, key-catalogue, 850.
 of sheep, control, Miss., 170.
- Parasitism—
 multiple, relation to biological control of insects, 851.
 recovery from, 855.
- Parasitology, animal, treatise, 167.
- Paratettix texanus*, parthenogenesis and inheritance of color patterns, 422.
- Paratuberculosis. (See Johne's disease.)
- Paratyphoid-enteritidis infections of rodents, carriers among, 875.
- Paresis, parturient. (See Milk fever.)
- Paris green—
 dilution for mosquito control, 454.
 dusting device for mosquito control, 274.
- Parlatoria blanchardi* fumigation with chloropicrin, 156.
- Parsley, culture experiments, P.R., 737.
- Parsnips, varieties, N.Y.State, 431.
- Parthenogenesis, geographic, 241.
- Paspalum, North American species, 131.
- Pasteurella avicida*, studies, 172, 473, 670.
- Pasteurella* strains, serological relations, 169.
- Pasteurization. (See Milk.)
- Pasture—
 grass, yield and composition, Vt., 252.
 grasses, increasing protein in, 425.
 land and crop land, income from, 178.
- Pastures—
 fertilizer experiments, Fla., 325; S.C., 625.
 irrigated, studies, Mont., 257.
 management research, symposium, 130.
 mixed seedings for, Ga.Coastal Plain, 729.
 of West Australia, 425.
 papers on, 424.
 studies, Del., 728; Fla., 325; Ind., 30. (See also Grasses and Grassland.)
- Patents of United States relating to pest control, U.S.D.A., 754.
- Pathology—
 comparative, in Australia, 167.
 comparative, in Japan, 167.
 fifty years of, 167.
- Faurocephala, new species, from China, 154.
- Pavement slabs, Arlington curing experiments, U.S.D.A., 882.
- Pea—
 aphid, natural enemies, biology, Wis., 56.
 aphid, studies, 649.
 plants, calcium and magnesium in, variations, 415.
 root tips, effect of absence of boron, 619.
 seeds, viability tests, 135.
- Peach—
 aphid, green, on tobacco, biology, 451.
 bacterial spot, notes, Del., 746; Ill., 346.
 borer, control, Miss., 137.
 borer injury and control, Okla.Panhandle, 656.
 chlorosis, treatment, 849; Calif., 745.
 diseases and insects, control, N.Y.Cornell, 740.
 moth, oriental—
 as orchard pest in Ohio, 540.
 baiting, Pa., 253.
 control, 248.
 growth, relation to temperature, 58.
 laboratory rearing, 58.
 life history in Georgia, U.S.D.A., 357.
 loss from, S.C., 855.
 notes, Del., 753, 754; N.Y.State, 449; S.C., 651.
 papers on, 541.
 parasites, in New Jersey, 156.
 survey, Ill., 252.

Peach—Continued.

- moth, oriental—continued.
- transferring parasites of, technic, 655.
- scale, white, parasites attacking, 252.
- trees, *Heterodera radiclecola* affecting, 145.
- trees, pruning and planting size, Ky., 227.
- worm, striped, notes, 241.
- yellow, carriers of, tests, Del., 746.

Peaches—

- breeding, Ill., 335; N.Y.State, 431.
- canning and drying, effect of irrigation, Calif., 777.
- clingstone, effect of irrigation, Calif., 786.
- codling moth infestation, 150.
- cold resistance, Mo., 39.
- cultivation methods, Miss., 38.
- dropping of flowers and immature fruits, Del., 749.
- fertilizer experiments, 526; Ohio, 40.
- from different sources, effect of nitrogen, Del., 735.
- frost injury, Tex., 637.
- frost resistant variety, Tex., 637.
- Georgia, marketing, Ga., 85.
- irrigated, canning quality, Calif., 527.
- J. H. Hale, pollination, Calif., 734.
- new variety, N.Y.State, 431, 738.
- pollination studies, N.Y.State, 739.
- propagation, S.C., 636.
- pruning, effect on yields, Ohio, 40.
- pruning, types, Can., 638.
- seedling stocks, N.Y.State, 432.
- spraying v. dusting, Miss., 39.
- thinning studies, Ill., 336.
- varieties in West Virginia, W.Va., 228.
- variety tests, Ind., 38; Miss., 38.

Peanut—

- oil utilization by rats and dogs, 291.
- virus disease, studies, 237.

Peanuts—

- breeding, Fla., 325; Tex., 627.
- culture experiments, Ark., 828; Fla., 325; S.C., 623.
- fertilizer experiments, Fla., 325; Ga. Coastal Plain, 729; S.C., 625.
- outlook for 1930, Okla., 784.
- varieties, Ga.Coastal Plain, 728.
- variety tests, Ark., 828; Tex., 626.

Pear—

- blight, control, Ky., 234.
- blight resistant trees, Ill., 346.
- chlorosis, treatment, Calif., 745.
- diseases, 149.
- diseases and insects, control, N.Y.Cornell, 740.
- fire blight resistant varieties, Pa., 347.
- leaves, leaching with cold water, 838.
- new variety, N.Y.State, 431.
- psylla, control, N.Y.State, 449.
- psylla problem, 648.

Pear—Continued.

- scab, notes, 238.
- shoots, Bartlett, composition and growth initiation, effect of temperature, 526.
- trees, tracheal sap, seasonal changes in, 433.

Pears—

- Australian, exported to England, wastage in, 850.
- Bartlett, breakdown in, relation to acetaldehyde, 341.
- Bartlett, ripening and storage behavior, U.S.D.A., 230.
- Bartlett, sterility in, causes, Vt., 339.
- breeding, N.Y.State, 431.
- canned, corrosion of cans, Calif., 786.
- faulty grafts in, Mich., 434.
- fertilizer experiments, Can., 638.
- from southern Oregon, notes, Miss., 38.
- grafting, preliminary budding in, Mich., 434.
- harvesting, storing, and ripening, Oreg., 41.
- home and commercial canned, vitamin values, 396.
- new or noteworthy variety, N.Y.State, 738.
- Pacific coast, supply and prices, Calif., 578.
- pollination studies, 434; N.Y.State, 738.
- production survey in United States and Canada, 140.
- seedling stocks, N.Y.State, 432.
- storage in artificial atmosphere, 841.
- varieties in West Virginia, W.Va., 228.
- variety tests, Miss., 38.

Peas—

- and barley, hogging off, N.Dak., 162.
- as cover crop in pecan orchards, Fla., 335.
- Austrian Winter field, as cover crop, S.C., 33.
- breeding, N.Y.State, 432.
- culture experiments, P.R., 737.
- cystine deficiency in, Ill., 391.
- fertilizer experiments, Miss., 39, 138; N.Y.State, 432.
- germination, 136.
- hogging off, N.Dak., 162, 367.
- pigeon, breeding, Fla., 325.
- seedling experiments, N.Dak., 138.
- spacing experiments, Can., 836.
- variety tests, Ga.Coastal Plain, 728; N.Dak., 129; Tex., 627.
- viability after treatment, 136.
- winter field, cutting tests, Ga.Coastal Plain, 729.

Peat—

- formation and decomposition, rôle of microorganisms in, 814.
- lands, irrigation studies, 173.
- soils of Florida Everglades, composition, 412.

- Pecan—
diseases, studies, Fla., 345; S.C., 642.
insects, studies, Miss., 53.
nut case bearer, spraying experiments, Fla., 352.
rosette, notes, Fla., 344.
shuckworm, studies, Miss., 53.
weevil, studies, Miss., 152.
- Pecans—
fertilizer experiments, Fla., 335.
production in Texas, 143.
- Pectin—
in apples at various stages of maturity, 434.
substances and breakdown by enzymes, 310.
- Pectinophora gossypiella*. (See Bollworm, pink.)
- Pegomya brassicae*. (See Cabbage maggot.)
- Pellagra prevention, work, 97.
- Pemphigus populitansversus*. (See Turnip root louse.)
- Penetrol—
addition to sprays, value, Del., 746.
use of term, Md., 243.
- Penicillium*—
blforme, notes, 538.
spp. in tissues, histological studies, Calif., 744.
- Penicillium—
injury to corn seedlings, 644.
rot effect on *Pseudomonas citri*, 52.
- Pennsylvania—
Association of Dairy and Milk Inspectors, reports, 554.
College, notes, 700.
Station, notes, 700.
Station, report, 399.
- Pentachlorethane, anthelmintic value, 877.
- Peonies—
fertilizer experiments, Ill., 338.
nomenclature, Ill., 338.
- Peony—
bud blight, notes, Mo., 46.
crown elongation disease, 646.
- Pepper—
plants, *Phytophthora* infections, P.R., 747.
weevil, studies, Calif., 752.
- Peppers—
culture experiments, V.I., 227.
in Java, insect affecting, 355.
strain tests, Ill., 337.
varieties, N.Y.State, 431.
- Perforadus sacchari* n.g. and n.sp., notes, 153.
- Peridermium strobi*. (See White pine blister rust.)
- Persimmon trees, culture, Calif., 735.
- Personality development, methods of study, 580.
- Perspiration, insensible, in infants, 92.
- Pest control, patents relating to, U.S.D.A., 754.
- Pests, subterranean, control, 355
- Petroleum—
oxidation products as insecticide activators, 151.
sulfonated oxidation products, insecticidal value, Md., 243.
- Pezizella* sp., notes, Fla., 345.
- Phacidiella discolor* in the Bristol Province, 536.
- Phaenacantha saccharicida*, biology and control, 57.
- Phaenoserphus viator*, post-embryonic development, 648.
- Phanerotoma tibialis*, parasite of codling moth, Del., 754.
- Pheasants—
Eimeria species in 287.
ring-necked, release from United States, P.R., 751.
- Phaetes agonus*, notes, Pa., 354.
- Phenological observations in 1928, 409.
- Phlox, genetics, Pa., 322.
- Phlyctaenia ferrugalis*. (See Greenhouse leaf tyer.)
- Phlyctaenia tertialis* parasites, bionomic notes, 545.
- Phoma* spp., studies, 148.
- Phomopsis californica*, perfect stage, Calif., 744.
- Phorbia cepetorum*. (See Onion maggot.)
- Phorids associated with leaf-cutting ants, 858.
- Phosphate—
fertilizer materials, comparison, 121.
of lime. (See Calcium phosphate.)
rock, composting, Ga., 21; Tex., 614.
rock, fertilizing value, Ill., 316.
- Phosphates—
comparison, Ill., 316; Tenn., 508.
in soils, field test for, Ill., 13.
water-soluble, in soils, tests, Mich., 12.
- Phosphatic fertilizers, effect on forage plants, Mont., 210.
- Phosphorites, Pollak, comparison with other phosphates, 121.
- Phosphorus—
and calcium ratio in growth of chicks, 461.
compounds in blood, determination, 864.
in blood, effect of excessive doses of irradiated ergosterol, 197.
in feces, relation to pH, 198.
in forage crops, effect of fertilizers, 549.
in hays of Quebec, 549.
in milk, mechanism of secretion, 871.
in tissues of plants and animals, 122.
metabolism of dairy cattle, 870.
- Photoperiodism, studies, P. R., 737.
- Phthorimaea glochinella* in tomatoes shipped from Mexico, 241.
- Phyllocoptes*—
massalongoi new to Britain, 360.
schlechtendali on apple, 360.
- Phyllophaga of Mississippi, Miss., 152.

- Phyllosticta leaf spot of tobacco, Fla., 345.
Phyllosticta rabei, notes, 147.
Phyllotoma nemorata, notes, 158.
Phymatrichum omnivorum—
 in nature, 644.
 notes, 145.
 Physical measurements of school children
 of native white stock, 92.
 Physiology—
 chemical, essentials, treatise, 893.
 statistical methods in, 192.
 treatise, 770.
Physotherus grossipes, studies, 853.
Phytodietus burgessi, parasite of codling
 moth, Del., 754.
Phytonomus posticus. (See Alfalfa weevil.)
 Phytopathology and plant protection, history, 144.
Phytophaga destructor. (See Hessian fly.)
 Phytophthora infections on pepper plants
 and fallen grapefruit, P.R., 747.
Phytophthora—
 infestans on tomato, 148.
 (See also Potato blight, late.)
 sp., inoculation tests, Calif., 744.
 sp., notes, Fla., 345.
 sporangia, comparative value of size,
 48.
Plesma quadrata, studies, 544.
 Pigeon fly, notes, S.C., 650.
 Pigeon hybrids, studies, 123.
 Pigeons, establishment of races with large
 or small thyroids, 216.
 Pigmentation of domestic animals, 324.
 Pigs—
 breeding, calcium requirements, Mo.,
 64.
 fattening rations, Colo., 254; Pa., 367.
 feeding and breeding experiments, Can.,
 549.
 feeding experiments, 255; Ark., 866;
 Calif., 762; Del., 763; Ky., 255;
 N.Dak., 162; Ohio, 65, 763; S.C.,
 680; U.S.D.A., 64.
 finishing, marine tankage v. digester
 tankage, Miss., 64.
 foreign trade in, U.S.D.A., 578.
 freemartin condition in, 325.
 grading, 867.
 growth and reproduction in, Mo., 761.
 intersexual, occurrence, 30.
 leg stiffness in, Calif., 762.
 locomotory disturbances, 558.
 northern, habits, breeding, and man-
 agement, N.Dak., 367.
 of two blood lines, comparison, 324.
 on pasture, supplements for, 163.
 outlook for 1930, Okla., 734.
 rations at weaning time, Mo., 64.
 skeletal structure, variations in, 550.
 skull defect in, inheritance, 625.
 (See also Sows and Swine.)
 Pine—
 beetle, regularity in propagation, 243.
 blister rust. (See White pine blister
 rust.)
 Pine—Continued.
 blueing in, 538.
 cell sap, osmotic pressure and pH,
 419.
 culture, Tex., 641.
 interior trim, special painting sched-
 ules, Calif., 742.
 lodgepole region, timber growing and
 cutting, U.S.D.A., 46.
 longleaf, reproduction, effect of graz-
 ing, Miss., 144.
 red, growth studies, Pa., 342.
 region in California, nursery and
 planting practice, U.S.D.A., 639.
 region, tractor logging costs in, Calif.,
 46.
 seed stored in metal cans, germina-
 tion studies, U.S.D.A., 843.
 seedlings, effect of zinc sulfate treat-
 ment for grass in nursery, U.S.D.A.,
 843.
 seeds, hastening germination, 844.
 shoot moth, studies, 855.
 slash, gum yield, U.S.D.A., 843.
 slash, methods of chipping, U.S.D.A.,
 843.
 stands, accelerated growth rate after
 thinning, U.S.D.A., 843.
 survival, effect of grazing and burn-
 ing, U.S.D.A., 843.
 tip moth, paper on, 649.
 volume, yield, and stand tables for,
 U.S.D.A., 343.
 yellow, sterilization of seed beds, 640.
 yield tables, 532.
 (See also White pine.)
 Pineapple—
 bran, vitamin and mineral content,
 Hawaii Pineapple Cannery, 457.
 fields, nematode control in, Hawaii
 Pineapple Cannery, 445.
 plants, behavior in water cultures of
 varying pH, Hawaii Pineapple Can-
 nery, 437.
 plants, effect of aluminum, Hawaii
 Pineapple Cannery, 419.
 plants, physiological and pathological
 studies, Hawaii Pineapple Cannery,
 418.
 plants, root system, Hawaii Pineapple
 Cannery, 437.
 Pineapples—
 fertilizer experiments, Hawaii Pine-
 apple Cannery, 342.
 Hawaiian canned, food value, Hawaii
 Pineapple Cannery, 489.
 indexes to maturity, P.R., 738.
 plant selection, P.R., 738.
 ripening period, effect of short day
 length, P.R., 737.
 selection of planting stock, Hawaii
 Pineapple Cannery, 342.
 Smooth Cayenne, persistence of charac-
 ters, Hawaii Pineapple Cannery,
 437.
 Pink bollworm. (See Bollworm, pink.)

- Pipe, culvert, earth pressure experiments, U.S.D.A., 475.
- Pipe joints, welded, tests of strength and design, 173.
- Pipes, carrying capacity, U.S.D.A., 778.
- Piricularia* sp., notes, Ark., 845.
- Piroplasma caballi* infection, studies, 548.
- Piroplasmiasis—
in Egyptian fowls, 566, 775.
infection studies in horses, 548.
- Pissodes, nematode parasites of, 547.
- Pissodes strobi.* (See White pine weevil.)
- Pistache, Chinese, culture, Tex., 641.
- Pistachio roots, *Heterodera radicumicola* on, 145.
- Pituitary extract, effect on milk yield, Mo., 71.
- Pituitary gland transplanting from guinea pigs to mice, effect, 324.
- Placenta, character in monkey embryo, 726.
- Planorbis quadreloupenensis*, notes, P.R., 771.
- Plant—
anatomy and vegetative propagation, U.S.D.A., 509.
breeding, handbook, 827.
breeding in Great Britain, 518.
bug, western leaf-footed, notes, 544.
cells, suction tension, 616.
(See also Cell.)
chromosomes. (See Chromosomes.)
containers, relation to growth, Pa., 433.
cover, effect on soil temperature and moisture of air, 313.
disease study, constant temperature and humidity chambers, 615.
diseases—
and injuries, 47.
in Montana, Mont., 234.
in Porto Rico, 146.
insects as transmitters, 450.
internal therapy in, 146.
relation to weather, 611.
studies, Ill., 346.
treatise, 144.
(See also Fungi and different host plants.)
food, copper in, 190.
growth—
apparatus for controlled conditions, 615.
effect of calcium compounds, 122.
effect of daily light period, 524.
effect on microorganisms in soil, 415.
relation to container in which grown, Pa., 433.
relation to weather types, 114.
lice of Texas Gulf coast, 656.
lice on truck crops, control, Tex., 652.
lice, scheme illustrating life, 450.
metabolism, calcium, potassium, and iron balance in, 618.
neoplasms, effect of X-rays, 122.
nutrients, migration during growth, 121.
nutrition Calif., 719.
- Plant—Continued.
nutrition, effect on susceptibility to parasites, 146.
pathogenes, differentiation by agglutination tests, 235.
pigmentation. (See Anthocyan, etc.)
pots, clay v. paper, pulp, and peat, Pa., 339.
Quarantine Act of August 20, 1912, 88.
rusts, treatise, 47.
tissues, analysis methods, Ky., 204.
tissues involved in transfer of salts, 122.
tissues, phosphorus in, 122.
- Plantago varia*, feeding experiments, 467.
- Plantain bunchy top disease in Ceylon, 238.
- Plants—
abnormalities in, utilization, 509.
absorption and positive antagonism, correlation, 821.
aluminum in, 190.
aluminum toxicity to, 620.
aquatic, use in mosquito control, 857.
effect of manganese, copper, zinc, and boron in, Ky., 203.
growing, automatic watering system with recorder, 820.
host and parasite, histological reactions between, 821.
house, care, N.J., 45; Ohio, 639.
imported, U.S.D.A., 213, 321.
in closed containers, effects, 23.
iodine in, 509.
living, Calotermes in, control, 853.
organic acids in, physiology, 24.
origin of species, effect of earth radiations, Calif., 723.
ornamental, culture, 138, 530.
ornamental, diseases of, Colo., 52.
ornamental, propagation, Ohio, 42.
ornamental, studies, Can., 524.
perennial, origin, history, and culture, 842.
poisonous, on ranges, Nev., 74.
(See also Livestock poisoning and specific plants.)
pollination. (See Pollination.)
resistant to cotton root rot, Tex., 637.
respiration. (See Respiration.)
response to length of day, 611, 612.
senescence in, rôle of magnesium, Vt., 319.
sex determination in, 726.
soil solution as nutrient medium, 23.
susceptibility to parasites, effect of nutrition, 146.
water utilization, 820.
wilting, relation to soil absorptiveness, 122.
wilting, soil moisture studies, 617.
woody. (See Woody.)
yield and composition, effect of different nutrients, 121.
zinc essential to normal growth, 619.
- Plasmodiophora brassicae.* (See Cabbage clubroot.)

- Platyedra goosypicella*—
notes, 453.
papers on, 647.
- Platyedra*, new chalcidoid parasites, 861.
- Platymetopius magdalensis*, life history notes, 853.
- Flows—
draft, effect of manuring silt loam soil, Mo., 77.
tests in Oderbruch soil, 673.
- Plum—
chlorosis, treatment, Calif., 745.
die-back, studies, 444.
diseases and insects, control, N.Y.Cornell, 740.
leaves, leaching with cold water, 838.
- Plums—
breeding, 139; N.Y.State, 431.
Bruce, culture experiments, Tex., 636.
codling moth infestation, 156.
culture experiments, Tex., 637.
curculio-injured fruits in, Ill., 335.
new or noteworthy varieties, N.Y.State, 738.
pollination studies, 434; N.Y.State, 738.
propagation studies, Can., 524; N.Y.State, 431.
varieties in West Virginia, W.Va., 228.
- Pneumonia, brooder, in baby chicks, Ill., 379.
- Poeciloscytus basalis*, effect on cotton plant, 655.
- Poisonous plants. (See Livestock poisoning, Plants, poisonous, and specific plants.)
- Polia oleracea*, biology, 242.
- Polistes as pests in bird houses, 547.
- Pollen—
longevity and viability, 525.
sterility of Collinson avocado, 842.
- Pollenia hasei*, studies, 450.
- Pollination—
of citrus fruits, 436.
studies of fruits, 434; N.Y.Cornell, 730; N.Y.State, 738.
(See also specific plants.)
- Polychroa*—
botrana, biology, 242.
botrana in German vineyards, 648.
viteana. (See Grape berry moth.)
- Polydactylism in man, recessive factor for, 514.
- Polydactyly in fowls, 725.
- Polyembryony in insects, 649.
- Polyhedral diseases of insects, 543.
- Polymastia in cattle, inheritance, 823.
- Polynema saga*, parasite of leafhoppers, 457.
- Polyploidy in relation to cereal crops, 511.
- Polyporus*—
balsameus, notes, 538.
gileus, biology, 150.
- Polystictus abietinus*, notes, U.S.D.A., 239.
- Pomace flies—
genetic studies with, 822.
miniature-gamma gene in, mutability, 822.
notes, 852.
- Pomegranate fruit spot, notes, 145.
- Pomegranates, composition, commercial maturity, and by-products, U.S.D.A., 842.
- Popillia japonica*. (See Japanese beetle.)
- Poplar yield tables, 532.
- Poppy bacterial blight, 646.
- Porta subacida*, notes, 538.
- Pork—
and products, foreign trade in, U.S.D.A., 578.
cost of production, Ill., 386.
in preferred ways, U.S.D.A., 90.
production outlook, usefulness to farmers, 89.
quality, effect of feeding of dam, Ark., 866.
slaughtering, cutting, and curing on the farm, Utah, 255.
soft, relation to soybeans in ration, Ill., 366.
- Porthetria dispar*. (See Gipsy moth.)
- Porto Rico—
Insular Station, notes, 600.
Insular Station, report, 99, 199.
Station, report, 796.
- Portulaca oleracea* feeding test, 558.
- Post-mortem diagnosis, handbook, 166.
- Posts, steel and wood, service tests, Ark., 879.
- Potash—
effect on tobacco, Conn.State, 832.
fertilizer experiments, S.C., 614.
fertilizer experiments with citrus, Fla., 334.
value, Ill., 316.
- Potassium—
availability and base exchange in rice soil, Ark., 811.
balance in plant metabolism, 618.
deficiency, effect on apple trees, 839.
effect on shape of sweetpotatoes, 429.
in alfalfa plants on different soil types, 220.
in culture medium, effect on carbohydrate production in plants, 819.
in tomato plants, translocation, relation to carbohydrate and nitrogen distribution, Ark., 817.
iodide as supplement to swine rations, Ill., 365.
luxury consumption by plants, Ark., 818.
nitrate in cheese, effect, 873.
nitrate method of determining lime requirement, Mo., 17.
permanganate as stimulant in rooting of cuttings, N.Y.Cornell, 736.
- Potato—
Association of America, proceedings, 222.
beetle, Colorado, quail as enemy, 351.

Potato—Continued.

- blackleg, notes, Mo., 47.
- blackleg transmission by seedcorn maggot, Me., 644.
- blight, early, 237.
- blight, late, notes, 536; S.C., 642.
- disease in Forez, 148.
- disease, new psyllid-yellow, transmission studies, 644.
- diseases—
 - contributions in American and foreign publications, 847.
 - control, N.Y.Cornell, 747.
 - degeneration, papers on, 223.
 - studies, Fla., 345.
 - virus, studies, 56.
 - virus, symptomatology, Mont., 234.
 - virus, transmission, 847.
- flea beetle injury, pathological feature, 455.
- flea beetle project, progress, West. Wash., 540.
- grade inspection service, N.Dak., 181.
- hollow heart, control, 847.
- insects, notes, N.Y.State, 449.
- leaf roll, insect transmission, 56.
- leaf roll, sprouting tests, N.Y.State, 439.
- mosaic control, indexing for, 843.
- net-necrosis disease, notes, Vt., 347.
- outlook charts, with explanations, U.S.D.A., 578.
- powdery scab, notes, 536.
- Rhizoctonia disease, control, Nebr., 748.
- scab, control, 848; Nebr., 748.
- scab control with organic mercury compounds, 848.
- scab, notes, Vt., 347.
- shipments, contact frosts in, 224.
- tubers, dormant, carbon dioxide and oxygen in, Calif., 722.
- tubers, dormant, chemical treatments, 225.
- tubers, thiourea for control of size, 224.
- wart immune varieties, identity, 223.

Potatoes—

- as best food staple, 223.
- breeding, N.Y.Cornell, 731.
- certification, papers on, 223.
- composition, effect of shape, 132.
- concentrated fertilizers for, value, Me., 36.
- dormancy, studies, Calif., 745.
- effect of mulching paper, N.Y.Cornell, 737.
- experiments, Ohio, 35.
- fertilizer experiments, Ark., 828; Fla., 325; Ga.Coastal Plain, 730; S.C., 625; West.Wash., 508.
- fertilizers for, concentrated, 224.
- harvesting machines, sieves for, 674.
- in their most palatable form, 223.
- iodine determination in, 893.

Potatoes—Continued.

- irrigation in Colorado, U.S.D.A., 224.
 - marketing, U.S.D.A., 285.
 - marketing, papers on, 222.
 - mulching test, Fla., 325.
 - production, statistics of, Me., 86.
 - rotation experiments under irrigation, U.S.D.A., 128.
 - scabby, loss from, Vt., 349.
 - seed—
 - certified, buying and selling pools, 223.
 - certified, tests, Miss., 31, 632.
 - certified, value, Tenn., 522.
 - cut v. whole, storage, 225.
 - disinfecting, U.S.D.A., 349.
 - effect of cultural methods and maturity, Nebr., 732.
 - effect of green-sprouting, N.Y.Cornell, 732.
 - freezing effects, U.S.D.A., 26.
 - from various sources, Md., 830.
 - impregnation with fertilizer, 830.
 - northern-grown certified, results, Mo., 31.
 - storage, papers on, 222.
 - treatment, 223, 848; N.Dak., 129; Tex., 642.
 - treatments, comparison, Nebr., 748.
 - spraying and dusting experiments, Me., 632.
 - tests, Lord Derby Gold Medal, reports, 130.
 - tuber index work, 223.
 - varieties, leaf index, 223.
 - variety tests, Alaska, 127; Ark., 828; Ga.Coastal Plain, 728; Mo., 31; N.Dak., 129; Tex., 626; U.S.D.A., 32.
 - yield and composition, effect of different nutrients, 121.
 - yield, effect of pH, 224.
 - yield, effect of rotting seed pieces, 223.
 - yield, effect of size of seed piece and planting rate, 131.
 - yield, effect of virus diseases, Miss., 145.
- Potato-tomato chimera, studies, 28.
- Potentiometer. electron tube, description, 607.
- Poultry—
- coccidiosis, prepatent and patent periods in, life cycle, 171.
 - cost of production, S.C., 661.
 - culling, 461.
 - Days, programs, Ohio, 90.
 - digestibility studies, 868.
 - disease laboratory at Farmingdale, L.I., 260.
 - diseases, 266, 471; Ill., 379; Ky., 266; Pa., 380.
 - diseases, diagnostic work, 260.
 - diseases, prevention and control, Kans., 670.

Poultry—Continued.

- diseases, treatment, 564.
 (See also *specific diseases*.)
 effect of lead arsenate, 653.
 farms, income from, N.J., 678.
 fecundity in, inheritance, N.Y.Cornell, 726.
 feeding and breeding experiments. Can., 549.
 feeding experiments, Ark., 867; Miss., 163; S.Dak., 68.
 (See also Chickens, Chicks, and Hens, laying.)
 foreign trade in, U.S.D.A., 388.
 genetic studies in, 725.
 hen-feathering in males, cause, 30.
 house, new adaptable, plans, Ohio, 80.
 houses—
 and equipment, Calif., 384.
 design relation to temperature, Calif., 776.
 for Connecticut, 480.
 for Idaho conditions, 275.
 ventilation, N.Y.Cornell, 780.
 ventilation and temperature control, Calif., 765.
 hybrid vigor in, 215.
 laying house equipment, 275.
 lice, mites, and worms, control, 474.
 management, confinement system, Pa., 368.
 market, methods for improving, 553.
 men, business records for, U.S.D.A., 678.
 nutritional requirements, Mo., 67.
 outlook for 1930, Okla., 784.
 plumage characterization, relation of gonadic structure, 30.
 preparation for market, S.Dak., 85.
 produce, preparing for market, 869.
 products, marketing, S.Dak., 85.
 raising for beginners in Hawaii, 461.
 rations and methods of feeding, N.J., 68.
 science and practice, treatise, 163.
 sectional wall nests, plans and costs, Ohio, 384.
 sexual organs and secretions, pH of, Ky., 256.
 treatise, 869.
 vitamin E requirements, 552.
 (See also Chickens, Duck, Fowls, etc.)
 Poverty grass composition at successive stages, 131.
 Power and labor, studies, Pa., 382.
 Prairies, fertilizer experiments, Okla., 211.
 Precolostrum, chemical composition, Mo., 72.
 Pregnancy—
 diagnosing in guinea pigs, 324.
 effect on anterior hypophysis, 826.
 in mares, diagnosing, Calif., 726.
 in the monkey, uterine bleeding as early sign, 726.
 occurrence of regular oestrus during, 324.
 Price forecasting, papers on, 884.

Prices—

- farmers' response to, 283.
 index numbers, Ohio, 387, 677.
 studies, Ill., 386.
 Primates, parasites of, key-catalogue, 850.
 Primulas, distribution from the Himalaya to China, 639.
Pristomerus baumhoferi n.sp., notes 860.
 Producers Livestock Commission Association of National Stock Yards, business analysis, U.S.D.A., 680.
 Prolamin, alcohol-soluble, of English ryegrass, isolation and purification, 802.
Prophysaon andersoni, notes, West.Wash., 541.
 Protein—
 diets, low, effect on rats, 789.
 intake of medical students, 582.
 requirements of baby chicks, Calif., 764.
 supplements, effect on feeding costs, Mich., 458.
 supplements for pigs, Del., 763; S. C., 660.
 supplements for pigs on rape pasture, Ohio, 763.
 Protein-carbohydrate ratios, effect on chicks, Pa., 368.
 Proteins—
 alcohol-soluble, of English ryegrass, isolation and purification, 802.
 alcohol-soluble, of naked barley, 202.
 animal, of different levels, effect on pullets, Pa., 368.
 characterization by Van Slyke's method, 204.
 in crops, effect of fertilizers, S.C., 615.
 in meat, studies, Mo., 9.
 in pasture grasses, increasing, 425.
 in reed canary grass on peat soil, 831.
 in sausage and other meat products, nutritive value, 391.
 in seeds, physicochemical properties, 202.
 in wheat, 430.
 source for baby chicks, 551.
 source for laying hens, Miss., 66.
 wheat flour, peptization by inorganic salt solutions, 801.
 Protocalliphora larvae, injury to nestling birds by, 455.
 Protocatechuic acid from pigmented onion scales, 237.
 Protoplasm, colloid chemistry, 309.
 Protozoa, intestinal—
 in man, treatise, 448.
 infection of chicks with, 776.
 Protozoology, treatise, 447.
 Provitamin D, fractionation studies, 805.
 Prune chlorosis, treatment, Calif., 745.
 Prune pulp, new uses, Calif., 786.
 Prunes—
 canning, swelling of cans, prevention, Calif., 786.
 production in Yugoslavia, U.S.D.A., 576.
 surplus, utilization, Calif., 489.

- Psallus seriatus*. (See Cotton flea hopper.)
Pseudococcus citri. (See Citrus mealybug.)
Pseudomonas—
 citri. (See Citrus canker.)
 malvacearum, notes, Fla., 343.
 radicicola. (See *Bacillus radicicola*
 and Nodule bacteria.)
Pseudoperonospora—
 cubensis, notes, 143.
 humuli, notes, 532.
Psila rosae. (See Carrot rust fly.)
Psylla—
 malii, studies, 56.
 pyricola. (See Pear psylla.)
 Psyllidae, studies, 154.
Pterandus rosa, control, 546.
Pteromalus alboannulatus, notes, 545.
Pterostichus niger larva, parasite of, 648.
Ptinus—
 hololeucus. (See Spider beetle, golden.)
 tectus, biology and damage, 450.
 Ptychostoma, new genus, erection, 671.
 Public relations, policies regarding, 682.
 Public speaking, course in, 89.
Puccinia—
 spp., notes, 147.
 spp., pycnia and aecia in, 643.
 triticea. (See host plants.)
 Pullets—
 all-mash method of feeding, Del., 765.
 egg production, effect of confinement,
 Del., 765.
 egg production, effect of time laying
 starts, Mo., 68.
 management, 552.
 summer shelter for, N.J., 80.
 (See also Chickens and Poultry.)
 Pullorum disease—
 agglutination test for, simplified, 670.
 carriers, apparatus for testing, 671.
 carriers, detection, Calif., 471.
 control project, 260.
 diagnosis, 471, 565, 878; Calif., 771.
 diagnosis, cloudy reaction in, 775.
 diagnosis, modified antigens for avoid-
 ance of cloudy reactions, 775.
 in Japan, 565.
 in pheasants, 171.
 in poult, 170, 472.
 in young ducks, 671.
 prophylaxis for, 171.
 studies, 471; Ark., 874; Ill., 379; Ky.,
 266; West. Wash., 557.
 testing for, 776.
 transmission among hens, 268.
 transmission in incubators, 879.
 Pulpwood, growing full stands, 144.
 Pummelo, double, of Banda and Ambon,
 529.
 Pumpkin bacterial leaf spot, 849.
 Purnell committees, national, work, 89.
 Pycnanthus, new genus, erection, 860.
Pycnoscelus surinamensis, life history, 450.
Pyrausta cardui as agricultural pest in
 Hungary, 241.
Pyrausta nubilalis. (See Corn borer, Euro-
 pean.)
 Pyrethrin I and II, insecticidal value, 244.
 Pyrethrum—
 active principles, new solvents for, 851.
 estimation of pyrethrin in, 244.
 spray fluid, preparation, 448.
 Pyridine, soil treatment with, 245.
Pyroderces falcata, notes, 542.
 Pyruvic acid, determination, 205.
Pythium—
 graminicolum n.sp., description, 535.
 sp., notes, Mo., 47.
 Pythium root rot, notes, 146.
 Quail, Elmeria species in, 267.
 Quail, value to potato grower, 351.
 Quarantines against cotton pests, enforc-
 ing in Mississippi, 650.
 Quince diseases and insects, control, N.Y.
 Cornell, 740.
 Rabbit—
 hutch, treatise, 164.
 myxoma, 558.
 ova, living developing, cinematographs,
 424.
 Rabbits—
 Angora, wool yield, effect of cod-liver
 oil and minerals, 462.
 castorrex, linkage studies, 623.
 eye defects in, 217.
 naked, a recessive mutation, 23.
 origin of races, 822.
 repellents against, 228.
 rex type, linkage relations, 623.
 size inheritance in, 323.
 Rabies—
 summary, 875.
 vaccine, tests, Ill., 376.
 virulence, sources, 564.
 Radiators—
 enclosures and shields for, 674.
 types, effect on air temperatures in
 room heating, 884.
 Radium—
 effect on Nicotiana, 215.
 irradiation of *Drosophila*, mutations
 from, 214, 621.
 Ragwort—
 chemical control, 635.
 control through insects, 247.
 eradication, 431.
 poisoning in cattle, 876.
 Raillietina, comparative investigations, 548.
 Rainfall—
 and forests in Japan, relations, 232.
 characteristics, relation to soils and
 run-off, 409.
 forecasting, long range, 409.
 maps of Wisconsin, 409.
 seasonal, over Europe, distribution, 114.
 Raisins, lye dip, effect of oils in, Calif., 786.
 Ramie, process of extraction, Calif., 727.
Ramphastos brevicarinatus, life history in
 Canal Zone, 240.
 Rams, selection, 550.

- Rams, swelled-head in, 167.
Ramularia areola, notes, 145.
- Range—
 industry, publications useful to, U.S.D.A., 160.
 plants, poisonous. (See Plants, poisonous, and Livestock poisoning.)
- Rape pasture for pigs, protein supplements, Ohio, 763.
- Raritan River pollution, studies, N.J., 572.
- Raspberries—
 black, layering, Ohio, 41.
 breeding, 139; Ill., 337.
 culture, West.Wash., 523.
 culture experiments, Alaska, 137.
 culture in Canada, 527.
 descriptive notes, N.Y.State, 431.
 diseases, Ohio, 645.
 effects of different heights of pruning, 230.
 fertilizer experiments, Miss., 39.
 new variety, N.Y.State, 431, 738.
 variety tests, S.C., 635.
 winterkilling, N.Dak., 138.
- Raspberry—
 anthracnose resistant variety, Ky., 227.
 aphids, studies, Minn., 451.
 bramble disease, control, Ill., 347.
 fruit worm, notes, West.Wash., 540.
 mosaic, notes, N.Y.State, 439; West.Wash., 532.
 Verticillium wilt, notes, West.Wash., 532.
- Rat bite fever spirochete, drug-fastness, 260.
- Rat flea survey—
 of Peking, 250.
 of San Juan, Porto Rico, 858.
- Rat poison fatal to pigs, Calif., 753.
- Ration, scorbutic, description, 198.
- Rats—
 albino, heat production, 192.
 albino, hydrocephalous skulls in, 625.
 blue mutation in, 822.
 control by red squill powders, U.S.D.A., 446.
 effect of amount of sexual indulgence on longevity, 517.
 effect of breeding rate on offspring, 127.
 experimental, high temperature deaths among, 192.
 growth and form, effect of diet, 894.
 in rice fields, control, 446.
 learning ability, and vitamin B deficiency, 897.
 resistance to *Bacterium abortus*, effect of diet, 876.
 spontaneous activity, comparison with ability to learn, 516.
 suckling, development on milk diet, 895.
 (See also Rodents.)
- Rayon industry, treatise, 598.
- Reagents and culture media, treatise, 311.
- Real estate, valuation, U.S.D.A., 782.
 (See also Farm real estate.)
- Red scale—
 California, on citrus, Tex., 652.
 control, papers on, 440.
 Florida, fumigation with chloropicrin, 156.
 resistant, studies, 448.
- Red spider—
 and tar-distillate washes, 252.
 mite, notes, Fla., 351.
 on bush fruits, 541.
- Red weevil in coconut palms, control, 456.
- Redwater. (See Texas fever.)
- Redwood—
 region, planting in, Calif., 741.
 seeds, germination, 844.
 siding, discoloration prevention, Calif., 742.
- Reed canary grass—
 on peat soils, proteins in, 831.
 studies, U.S.D.A., 36.
- Refrigeration—
 cold storage, and ice making, treatise, 571.
 dairy, in California, 384.
 electrical, requirements for dairy farms, Pa., 382.
 mechanical, 275.
- Refrigerator, home electric, cost of electricity, S.Dak., 99.
- Reindeer—
 handling, improved, U.S.D.A., 364.
 husbandry and parasites in Norway, 241.
 recipes, U.S.D.A., 287.
- Reproduction—
 and life, treatise, 515.
 and origin of offspring, seventeenth century views, 515.
 endocrine regulation, 625.
 in birds, physiology, 515, 825.
- Reproductive organs in guinea pigs, cyclic changes in, 324.
- Research—
 at Ontario Agricultural College, 220.
 cooperation in, 88.
 functioning, administrative responsibilities, 88.
 place on program of land-grant colleges, 101.
 (See also Agricultural research.)
- Respiration—
 in insects, 151.
 of apples, apparatus for determination of carbon dioxide in, 139.
- Respiratory gaseous exchange in man, effect of sun and air and air baths, 290.
- Rhabdochline pseudotsugae*, notes, 149.
- Rhagoletis*—
cingulata. (See Cherry maggot.)
juglandis, life history and control, 455.
pomonella. (See Apple maggot.)
- Rhizobium leguminosarum*, isolation, 816.

Rhizoctonia—

- bataicola*, new hosts of, 235.
- bataicola*, parasitism, 236.
- destructans*, notes, 535.
- solani*, notes, 535; Fla., 343.
- sp., notes, Fla., 345; Miss., 145.

Rhizoglyphus—

- echinopus*, bionomics, 360.
- hyacinthi*, notes, West.Wash., 59.

Rhode Island College, notes, 798.

Rhopalosiphum pseudobrassicæ. (See Turnip aphid.)

Rhubarb—

- varieties, N.Y.State, 431.
- vitamin C in, Mo., 95.

Rhyacionia frustrana, paper on, 649.

Rhynchites auratus ferganensis n.subsp. on apricot, 242.

Rhyncophorus ferrugineus in coconut palms, control, 456.

Rhyssa persuasoria, parasite of *Sirex*, 359.

Rice—

- and beans as sole diet, 583.
- anthocyan distribution in, 429.
- borer moth attraction to lights, 156.
- breeding, Tex., 627.
- by-products, feeding value, Ark., 866, 869.
- chlorosis in, cause, Ark., 844.
- depth of irrigation water for, 474.
- diseases, classification, Ark., 845.
- effect of fertilizers, Ark., 829.
- effect of temperature of irrigation water, 132.
- farms, organization, management, and costs, Ark., 885.
- fertilizer experiments, Ark., 828; Tex., 627.
- fields, rats in, control, 446.
- improvement in Japan, 620.
- insects affecting in Madagascar, 542.
- irrigation, pumping plants for, Ark., 879.
- kernels, checking, factors affecting, Calif., 777.
- loss in hinding, 384.
- nitrogenous fertilizers for, availability, 225.
- pest, new, in South India, 853.
- plant, mutation in, papers on, 620.
- polish, feeding value, Ohio, 65.
- polished, feeding to horses, effects, 260.
- products for poultry, Ark., 867.
- seed ripening, chemical studies, 202.
- soil, studies, Ark., 810.
- variety tests, Tex., 626.
- weevil in stored rice, 542.
- weevil injury to corn, S.C., 651.
- weevil, life history notes, 456.

Rickets—

- and cereals, 898.
- control in the clinic, 898.
- in chicks, 662.
- in children, pH and composition of feces, 197.
- in rats, 694.

Rickets—Continued.

- in rats, curative action of dried and condensed milk, 898.
- local factor in pathogenesis and cure, 694.
- modern therapy for, 496.
- producing factor in cereals, nature, 594.

Rickettsia diseases—

- and filtrable virus, 169.
- in Tropics and filtrable virus, 467.

Rinderpest—

- complement fixation reaction in, 260.
- immunization, 469.
- vaccine, experiments on, 260.

River pollution, Raritan, studies, N.J., 572.

Roach, Surinam, life history, 450.

Road materials, accuracy of specific gravity and absorption tests, 271.

Roads—

- and agriculture, relation, N.Y.Cornell, 278.
- bituminous surface treatment experiments, U.S.D.A., 271.
- concrete. (See Concrete.)
- farmer's interest in, 572.
- gravel, topsoil, and sand-clay in Georgia, U.S.D.A., 78.
- sand-clay and topsoil, bituminous surface treatment, 779.
- (See also Pavement.)

Robins, enemies of iris borer, 856.

Rock—

- for road building. (See Road materials.)
- gardens, planning and planting, 143.
- phosphate. (See Phosphate.)
- products as mineral feeds, N.Y.Cornell, 760.

Rodents—

- control, Tex., 652.
- insectivorous, enemies of iris borer, 856.
- of Colorado, control, 539.
- (See also Mice and Rats.)

Roentgen rays. (See X-rays.)

Rogas sp., notes, 855.

Root—

- crops, production tests, Alaska, 127.
- development relation to soil moisture, Calif., 778.
- knot nematode, control, Fla., 344.
- knot nematode of gladiolus bulbs, 145.
- nodules. (See Nodule bacteria.)
- rot due to *Pythium* and *Aphanomyces*, 146.

Roots, metabolism, Mo., 23.

Rope, knots, hitches, and splices, strength tests, 174.

Rosaniline hydrochloride use in isolating nitrite-oxidizing organisms, 417.

Rose scale, parasites attacking, 252.

Roses—

- culture, treatise, 438, 639.
- hardy, for South Dakota, S.Dak., 231.
- red, cause of blueing in, 820.

Roses—Continued.

seedling stocks, N.Y.State, 432.
summer-budded v. winter-grafted, Ill., 338.

Rotation—

fertilizer tests, S.C., 507.
of crops, Alaska, 127; Del., 728; Fla., 325; Ind., 80; Ky., 210; Miss., 31; N.Dak., 129; Tex., 614, 627.
of crops under irrigation, U.S.D.A., 128.

Roughage—

effect on growth, 688.
fed in different forms, value, Kans., 362.

Roughages, feeding value, Miss., 161.

Roundworm parasite of chickens, new, 474.

Roundworms—

in chicks, control, 566.
intestinal, collecting, technic, 467.
specific identity, 670.

Royal Veterinary College, report, 260.

Rubber—

milkweed as source, 419.
root disease, relation to cover crops, 239.

Rumplessness in fowls, 324.

Run-off—

estimating from mountain snows, 409.
from small agricultural areas, estimation, 475.

Rural—

behavior, 580.
children of pre-school age, nutritive condition and food habits, S.C., 289.
church, rôle in community life, Va., 185.
community in transition, 581.
community life, rôle of the church in, Va., 185.
community trade and culture, 582.
credit. (*See* Agricultural credit.)
depopulation in Virginia, 185.
education, papers on, 580.
electrification, trend in, 571.
groups, effective location, Mo., 86.
houses, plans, 572.
labor. (*See* Agricultural labor.)
life improvement, papers on, 486.
migration, papers on, 580.
organizations and the farm family, Wis., 784.
population, distribution, N.Y.Cornell, 184.
population in Missouri, movements, Mo., 86.
population, migration, Wash.Col., 87.
research, papers on, 580.
social science, textbook, 891.
sociological adult education in United States, 684.
sociological research in United States, 682.
sociology as field of research, 88.
sociology, papers on, 579.

Rural—Continued.

sociology, textbook, 183.
women, living conditions, papers on, 277.

(*See also* Community.)

Rush sawfly, studies, 159, 859.

Rust fungi, pycnia and aecia in, 643.

Rusts—

of Pennsylvania, Pa., 440.
teliospore and urediniospore formation, control, 643.
treatise, 47.
(*See also specific hosts.*)

Rutabagas. (*See* Swedes.)

Rye—

and rye products, foreign trade in, U.S. D.A., 889.
as forage crop, Mont., 219.
as green manure, N.Y.Cornell, 737.
biology, 319.
culture in Russia, 522.
ergot, calcifying action, 588.
fall, in North Dvina, 243.
variety tests, Ind., 80; S.C., 625.
yield and composition, effect of different nutrients, 121.

Ryegrass, western, improvement, 429.

Rye-wheat hybrid, prophases of heterotypic division in, 511.

Safflower, types, description, 633.

Sagaritis oxylus, notes, 855.

Sagrain—

fertilizer experiments, Miss., 128.
silage grain fed to cows, losses in manure, Miss., 69.
v. corn chops for dairy cows, Miss., 164.

St. John's wort—

immature, effect on sheep, 558.
toxic principle, 558.

St. Lawrence navigation and power project, 280.

Saissetia oleae. (*See* Black scale.)

salmon, canned, pellagra-preventive action, 595.

salmonella—

aertrycke infection in canary birds, 268.
pullorum, production of gas by, R.I., 564.
pullorum, studies, 171; Pa., 380.
(*See also* *Bacterium pullorum* and *Pullorum* disease.)
schottmülleri infection in pigeons, 269.
spp. infection of rodents, carriers of, 875.

Salt requirements of work mules, Miss., 163.

Salt River Valley project in Arizona, economic survey, 281.

Saltbush, Australian, composition and digestibility, Colo., 60.

Saltpeter. (*See* Potassium nitrate.)

Salts, acids, and bases; electrolytes; stereochemistry, treatise, 310.

Salvia, development of the hilum in, 136.

Samia cecropia, westward spread, 242.

- San Jose scale—
control, Mo., 40.
sterility in, 653.
- Sand and gravel industry, simplification of sizes in, U.S.D.A., 882.
- Sanninoidea exitiosa*. (See Peach borer.)
- Sarcophaga* spp., notes, 856.
- Sarcosporidia in Korean cattle, 167.
- Satin moth quarantine, Conn.State, 599.
- Saturnioids, American, taxonomic observations, 650.
- Satyrid, variable palearctic, 647.
- Sauerkraut—
fresh, and juice, vitamin C in, 588.
quality, effect of fermentation temperature, 11.
- Sawfly, western grass-stem, on small grains, U.S.D.A., 548.
- Scale insects—
fungal parasite of, 360.
studies, Miss., 54, 152.
- Schistocerca gregaria*—
control, 56.
in Armenia, 542.
invasion of Palestine, 853.
- Schistosoma mansoni*, notes, P.R., 771.
- Schistosoma of human blood, life history film, 241.
- Schizocerophaga leihi*, notes, Va.Truck, 859.
- Schizocerus* spp., synonymy, Va.Truck, 859.
- Schizoneura lanigera*. (See Apple aphid, woolly.)
- Schools—
agricultural. (See Agricultural school.)
folk high, of Denmark and development of farming community, 187.
vocational. (See Agricultural schools, vocational.)
- Sciara coprophila*, sex studies, 512.
- Science application to crop production, treatise, 701, 796.
- Scientific Society of the Hygiene of Nutrition, 597.
- Sclerophoma entocyliina* n.sp., notes, 538.
- Sclerosporea philippinensis* on teosinte, 443.
- Sclerotium*—
cepivorum, notes, 536.
oryzae, notes, Ark., 845.
raifisi, notes, 535.
- Scolytids, biology, 242.
- Scurvy in guinea pigs, production, 198.
- Seed—
control, Mont., 219.
control, papers on, 135, 136.
drill, movements of seeds and fertilizers in, apparatus for motion pictures of, 673.
laboratories, working libraries of, 136.
laws, papers on, 135, 136.
proteins, physicochemical properties, 202.
testing, botany of, 136.
testing laboratory, work, N.Y.State, 430.
- Seed—Continued.
testing methods, European and American, 136.
testing, statistical methods in, U.S.D.A., 227.
tests, N.H., 334.
- Seedcorn maggot, transmission of potato blackleg by, Me., 644.
- Seed—
analysis, Vt., 733.
certification in Germany, 220.
coniferous, germinative energy, 618.
effect of heat, Mo., 54.
germination, bibliography of, 834.
germination, effect of fumigants, 510.
germination, papers on, 135, 136.
hard, studies, Mont., 219.
inspection, Ind., 834.
light-sensitive, germination, effect of oxygen, 23.
oil. (See Oil seeds.)
sale, State laws concerning, N.J., 523.
scarified, germination tests, 136.
treated with cathode rays, effect, 136.
viability determination, 135.
viability, measurements of conductance and reduction, 617.
- Septic tanks, sludge accumulation in, Ill., 381.
- Septicemia—
of honeybees, 649.
puerperal, treatment, 294, 560.
- Sericulture. (See Silkworms.)
- Serum calcium, effects of protein and phosphorus, 789.
- Setaria* spp., new, of deer and reindeer, 269.
- Sewage disposal for rural homes, 275, 384, 572.
- Sewing center, organization in the home, N.Y.Cornell, 497.
- Sex—
and heredity, 624.
characteristics, accessory, growth disharmony, 515.
determination in animals and plants, 726.
glands, hormones of, 515.
quantitative theory, 726.
ratio in chickens, 423.
ratios, aberrant in pigeon hybrids, 123.
studies in *Sciara*, 512.
variations in different species of animals, 824.
- Sexual cycle of female domesticated mammals, 517.
- Sheep—
bloat on sweetclover pastures, Mont., 260.
blowflies, studies, 358, 858.
club members, manual, Ill., 890.
Corriedale, adaptation to Texas conditions, Tex., 659.
cost of keeping farm flock, Mo., 82.
cost of production, Oreg., 575.

Sheep—Continued.

feeding and breeding experiments, Can., 549.

fine-wool flocks, systems of management, Ohio, 62.

hookworms, control, 877.

husbandry, treatise, 187.

industry, economic aspects, Calif., 280.

liver fluke, larval forms in snails, Calif., 752.

maggot, parasite of, 860.

outlook for 1930, Okla., 784.

parasites, control, Miss., 170.

pasturage and silage production for, Nev., 62.

poisoning by soursofs, 167, 170.

poisoning with milkweed, 558.

(See also Livestock poisoning, Plants, poisonous, and specific plants.)

production in range country, U.S.D.A., 160.

production in Upper Peninsula of Michigan, 162.

production, treatise, 162.

pyemic disease, 76.

Rambouillet, body and fleece weights, Tex., 659.

Rambouillet, type in, Tex., 658.

scab control, Tex., 666.

scab in Great Britain, data, 260.

shearing, once v. twice a year, Tex., 659.

stomach worms, Conn.Storrs, 378.

variations in, 421.

(See also Ewes and Lambs.)

Shelter belts—

for central Montana, Mont., 233.

on Great Plains, planting and care, U.S.D.A., 144.

Shrubs, transplanting, U.S.D.A., 144.

Silage—

composition and milk producing value, 802.

corn, ear v. shelled, for finishing calves, Ill., 361.

corn, proteins in, biological value, 657.

corn, types, relative feeding values. Conn.Storrs, 371.

crops, tests, Miss., 31, 128.

cutters, energy requirements, Kans., 333.

from sweet corn cannery refuse, Ill., 370.

oat, for utilization of badly lodged grain, Ill., 362.

production, biochemical course, 803.

stover, feeding value, Ill., 362.

sunflower, proteins in, biological value, 657.

Silica—

determination of manganese in presence of, 203.

gel, addition to Portland cement mortars, effect, 569.

Silica—Continued.

in forage crops, effect of fertilizers, 549.

Silicates, soluble, in industry, treatise, 707.

Silicic acid, precipitated, dehydration by ignition, 806.

Silk—

artificial. (See Rayon.)

effect of tin weighting, 793.

unweighted and weighted, effect of dry cleaning, 794.

unweighted and weighted, effect of home laundry methods, 794.

Silkworm muscardine, pathogeny, 544.

Silkworms—

color relation to environment, 648.

double cocoon formation in, 648.

linkage in, 620.

relation of blood constituents to flacherie, 452.

voltinism of, 620.

Silos, filling with 3 h. p. motor, 571.

Silverberry bush, feeding value, Alaska, 160.

Sipha flava, notes, 153.

Siphonaptera, North American, 648.

Sires—

breeding, selection, N.J., 658.

dairy, care, feeding, and management, Mo., 767.

dairy, transmitting ability, Ill., 370.

purebred dairy, selection, Mo., 767.

Sires—

cyaneus, biology, 359.

gigas, notes, 359.

Sisal—

production, 831.

waste, use as source of power alcohol, 672.

Sitophilus—

granaria. (See Granary weevil.)

oryza. (See Rice weevil.)

Sitotroga cerealella. (See Angoumois grain moth.)

Skim milk feeding value for pullets, Pa., 368.

Skins. (See Hides.)

Skull defect in swine, inheritance, 625.

Skunks, eastern, winter food, 151.

Slaughterhouse waste, feeding value, 255.

Sleepy grass poisonous to livestock, U.S. D.A., 74.

Slugs, garden, alum spray treatment for, Calif., 753.

Snail, European brown, control, 448.

Snakeroot, white, poisonous to livestock, U.S.D.A., 75.

Snow cover on mountains, measuring, 409.

Soaps—

effect on dress gingham, 794.

insecticidal properties, 656.

Social—

and family relations, teaching in high school, 89.

research methods of gathering data, 184.

Social—Continued.

- research, statistics in, 286.
- sciences, research in, treatise, 580.

Sociological—

- adult education, rural, in United States, 684.

- research, rural, in United States, 682

Sociology—

- American, trends in, 890.
- of the family, N.Y.Cornell, 684.
- rural, papers on, 579.
- rural, textbook, 183.
- rural-urban, treatise, 286.

Sodium—

- chlorate as lawn weed killer, Ohio, 334.
- chlorate for bindweed eradication, Wash.Col., 37.
- chlorate, toxicity for cattle, 562.
- fluosilicate as house fly poison, 241.
- nitrate, fertilizing value, Tex., 614.
- silicofluoride dusts, qualities and distribution, 658.
- trichloracetate, anthelmintic value, 877.

Soil—

- acidity and nodule organisms, Ill., 329.
- acidity in greenhouse soils, Ohio, 42.
- acidity studies, Del., 718; Ill., 212.
- and field crop management for Yates County, N.Y.Cornell, 82.
- bases and acidity, vertical distribution, 411.
- basicity, studies, Tex., 718.
- colloidal behavior, laws, 410.
- disinfection with organic mercury compounds, 848.
- dynamics, research, relation to tillage implement design, Ala., 78.
- erosion—
 - prevention and run-off water conservation in Texas, 270.
 - prevention and water conservation in North Carolina, 269.
 - prevention in new clearings, 812.
 - prevention, platform terrace system, 812.
 - projects, Federal, 269, 498.
 - studies, Mo., 16.
 - study project, 698, 800.
- fertility experiments, history, 818.
- fertility, maintenance, 809.
- fertility relation to vitamin A in lettuce, 193.
- fertility studies, Ind., 317; Nev., 18; S.C., 507; Tex., 614.
- heating, electrical, 672.
- heaving, causes and effects, Mich., 20.
- moisture—
 - and crop yield, Okla., 217.
 - and fertility conservation, 270.
 - at permanent wilting of plants, 617.
 - conservation studies, Tex., 614.
 - effect of green manures and cover crops, 815.

Soil—Continued.

moisture—continued.

- importance in forestry, 530.
- problems for heavy soils, Okla., 210.
- report, Okla.Tanhandle, 812.
- retention, effect of cultivation, Ark., 814.
- studies, Calif., 717.
- utilization on heavy soils, Okla., 412.
- mulch, moisture conservation by, 812.
- problems of Wheatland project, Wyo., 306.
- productiveness, studies, Tex., 614.
- profile studies, 410.
- reaction, effect of adsorbed ions, 118.
- reaction profile, 811.
- reaction, seasonal fluctuations in, Conn State, 833.
- resources of Montana, Mont., 210.
- Science, International Congress, notes, 300.
- science, treatise, 501.
- solution as nutrient medium for plants, 23.
- survey in—
 - Arkansas, Bradley Co., U.S.D.A., 117.
 - Arkansas, Nevada Co., U.S.D.A., 117.
- California—
 - Chico area, U.S.D.A., 18.
 - King City area, U.S.D.A., 116.
 - Oroville area, U.S.D.A., 715.
 - Saltinas area, U.S.D.A., 713.
- Georgia, Quitman Co., U.S.D.A., 117.
- Idaho, Soda Springs-Bancroft area, U.S.D.A., 19.
- Iowa—
 - Carrol Co., U.S.D.A., 715.
 - Cherokee Co., Iowa, 20.
 - Chickasaw Co., U.S.D.A., 716.
 - Delaware Co., Iowa, 19.
 - Fremont Co., Iowa, 20.
 - Howard Co., U.S.D.A., 19.
 - Jones Co., Iowa, 20.
 - Warren Co., U.S.D.A., 714.
- Massachusetts, Middlesex Co., U.S.D.A., 209.
- Michigan, Alpena Co., U.S.D.A., 117.
- Michigan, Roscommon Co., U.S.D.A., 116.
- Minnesota, Lac Qui Parle Co., U.S.D.A., 418.
- Nebraska, Nuckolls Co., U.S.D.A., 714.
- Nebraska, Webster Co., U.S.D.A., 115.
- New Jersey, Salem area, U.S.D.A., 317.
- New York, Columbia Co., U.S.D.A., 116.

Soil—Continued.

survey in—continued.

New York, Herkimer Co., U.S.D.A., 116.

North Carolina—

Nash Co., U.S.D.A., 715.

Northampton Co., U.S.D.A., 117.

Rockingham Co., U.S.D.A., 715.

Wilson Co., U.S.D.A., 713.

North Dakota, Cass Co., U.S.D.A., 413.

Oregon, Linn Co., U.S.D.A., 116.

South Australia, Renmark irrigation area, 811.

South Dakota, Hyde Co., U.S.D.A., 714.

South Dakota, Moody Co., U.S.D.A., 715.

Texas, Hidalgo Co., U.S.D.A., 714.

Texas, Willacy Co., U.S.D.A., 715.

West Virginia, Monroe Co., U.S.D.A., 714.

Wisconsin, Calumet Co., U.S.D.A., 714.

technology, Calif., 717.

technology, principles, treatise, 810.

temperature studies, Calif., 717.

temperature, surface, effect of plant cover, 813.

type in farm economy, significance, 276.

types in logged-off areas, Idaho, 19.

water. (See Soil moisture.)

water vapor pressure, relation to soil water content, 122.

zeolites, base-exchange capacity, Ariz., 506.

Soiling crops, notes, V.I., 220.

Soils—

acid. (See Soil acidity.)

alkali. (See Alkali.)

and fertilizer work, Mo., 16.

buffer action in, mechanism, Del., 718.

corrosiveness with respect to iron and steel, 271.

examination methods, 410.

heavy, moisture problems, Okla., 210.

impervious, leaching, U.S.D.A., 20.

improvement, Ill., 314.

inoculation. (See Legumes, inoculation.)

lime requirement indicator, potassium nitrate method, Mo., 17.

lime requirements, determination, antimony electrode for, 407.

lime requirements, tests, Mo., 22.

nature and properties, treatise, 810.

nitrogen content. (See Nitrification and Nitrogen.)

of Cass County, North Dakota, composition, U.S.D.A., 413.

of Coles Co., Ill., 118.

Soils—Continued.

of Las Vegas Valley, nitrogen value studies, Nev., 18.

of Libyan oases, 811.

of Macon County, Ill., 716.

of Moapa Valley, nitrogen value studies, Nev., 18.

of Punjab, 413.

of Willamette Valley, colloidal properties, 411.

organic matter in. (See Organic matter.)

peat. (See Peat.)

pH determinations, antimony electrode for, 407.

phosphates in, tests, Ill., 18; Mich., 12.

physiological reaction, 119.

slick-spot, analyses, Nev., 18.

studies, Ill., 314.

studies, green manure project, Fla., 317.

ultimate natural structure, 410.

volcanic, of Sakurajima, Japan, microbiological studies, 118.

Sollvita, results from use, Iowa, 32.

Soldier beetle, notes, Del., 754.

Solenopsis geminata. (See Fire ants.)

Solutions, nutrient. (See Culture media.)

Sore mouths of kids and lambs, treatment, Tex., 667.

Sore shin, notes, 145.

Sorghum—

and Sudan grass hybrids, 633.

culture under dry land conditions, N. Mex., 32.

disease, new, destructive to milo, Tex., 642.

grain, breeding, Tex., 627.

grain, culture experiments, Tex., 627.

grain, effect of green manure, Calif., 727.

grain, harvesting methods, Calif., 332; U.S.D.A., 132.

grain, inheritance studies, Tex., 627.

grain, seeding experiments, U.S.D.A., 331.

grain, spacing experiments, U.S.D.A., 331.

grain, varieties, improvement, Okla. Panhandle, 633.

grain, variety tests, Tex., 626.

harvesting by root cutting and combining, 273.

root development, relation to soil moisture, Calif., 727.

roughage, preparing for lambs, Tex., 659.

silage quality, effect of thick planting, Miss., 69.

smuts, notes, 535.

smuts, toxicity tests, 876.

variety tests, V.I., 219.

Sorgo—

- breeding, Tex., 627.
- for sirup, culture, harvesting. and handling, U.S.D.A., 733.
- sirup, manufacture, Ark., 829.
- variety tests, Tex., 626.

Soursobs, poisoning of sheep by, 167, 170.

South Carolina Food Research Commission, organization and activities, 893.

South Carolina Station, report, 696.

South Dakota College, notes, 498.

Sows—

- brood, labor cost of caring for, Mo., 82.
- pregnant, food needs, Ill., 365.
- (See also Pigs.)

Soybean—

- bacterial pustule disease, varietal resistance, 443.
- diseases of foliage, Del., 746.
- food preparation for infants, 584.
- hay and seed production, U.S.D.A., 226.
- hay, ground v. unground, for dairy cows, Md., 870.
- plant, fertility value in, Ill., 316.
- seed treatments, Del., 748.

Soybeans—

- as supplement to brood sow rations, Ill., 366.
- breeding, Miss., 31, 128; Mo., 31; N.Y.Cornell, 731.
- cost of production, Ill., 386.
- culture experiments, Ark., 828; Fla., 325; Miss., 31, 128.
- feeding value, Ark., 866; Ill., 366; Ohio, 764.
- ground, effect on market milk and butter, S.C., 665.
- inoculation studies, Miss., 31, 128.
- nodulation, relation to calcium, 226.
- production with mechanical power on alluvial lands, 175.
- relation to soft pork, Ill., 366.
- seeding experiments, Ill., 328.
- utilization, U.S.D.A., 733.
- value for egg production, Mo., 67.
- value for soil improvement, Ill., 329.
- variety tests, Ark., 828; Del., 728; Fla., 325; Ga.Coastal Plain, 728; Ill., 328; Ind., 30; Miss., 31, 128; Mo., 31; N.Y.Cornell, 522; Tex., 626; V.I., 219.

Sparison pilosum, notes, U.S.D.A., 654.

Species problem in light of genetics, 214.

Spermatogenesis—

- in guinea pigs, effect of X-rays, 516.
- in ovariectomized fowls, 325.

Spermatozoa—

- dimorphism, 124, 726.
- duration of life in female tract of animals, 515.
- human, microdissection studies, 424.

Spermatozoa—Continued.

- mammalian, problems in physiology of, 125.

- of the bull, size and forms. Mo., 29.

Sphaerotheca humuli, notes, 532.

Sphegidae of South Africa, 861.

Spices, bibliographical summary, U.S.D.A., 312.

Spider beetle, golden—

- anatomy, 450.

- studies, 260, 859.

Spider mite. (See Red spider.)

Spiders—

- of Porto Rico, 548.

- red. (See Red spider.)

Spinach—

- canned, effect of storage on vitamin value, 93.

- effect of cooking method on vitamin B in, Mo., 94.

- fertilizer experiments, Ill., 337.

- inorganic elements for nutritional anemia, 297, 695.

- leaves, vitamin A in, relation to size, 791.

- varieties, descriptions, Md., 840.

- vitamin C in, Mo., 95.

Spirochaeta—

- gallinarum*, attempted transmission to fowls, 172.

- morsus muris*, drug fastness, 167, 260.

Spirochetes—

- affecting swine, Calif., 771.

- rat bite fever, drug fastness, 167.

Splices, hitches, and knots, strength tests, 174.

Spongospora subterranea, notes, 536.

Spray—

- residues, removal from fruit, 245, 648; N.Y.State, 740, 741.

- schedules, N.J., 840.

Spraying plants, stationary, 571.

- (See also special crops.)

Sprays—

- colorless, for Delaware grapes, Del., 745.

- copper. (See Copper.)

- for fruit trees, tests, Mo., 40.

- nonpoisonous, effect on insects, 450.

- oil, mixing and application, 851.

- preparation and use, Oreg., 839.

- (See also Insecticides, Fungicides, and specific forms.)

Spruce—

- blueing in, 538.

- girdling hardwoods to release, 844.

- second-growth, yields, U.S.D.A., 531.

- sterilization of seed beds, 640.

Spurge, petty, feeding experiments, 467.

Squash—

- bacterial leaf spot, 849.

- downy mildew or leaf blight, infection experiments, Del., 746.

- seedlings, growth and nitrogen metabolism, 837.

- Squill powders, red, as raticides, U.S.D.A., 446.
- Squirrel, thirteen-lined ground, hibernation, 151, 539.
- Squirrels, red, life history and habits, 240.
- Stachys arvensis*, shivers-producing principle of, 467.
- Stalk borer, southern, studies, S.C., 651.
- Stallion enrollment, Ind., 867.
- Stamodcres uniformis*, control, Calif., 752.
- Standards of living in Virginia, 531.
- Staphylococcus aureus*, effect on meat extracts, 110.
- Starch exhaustion in leaf wilting, 25.
- Statistical methods, merits and applications, 424.
- Stearates as diluents for Paris green in Anopheles control, 454.
- Steel—
corrosion-resistant and heat-resistant, developments, 882.
joints, bolted, riveted, and welded, tensile strength, 477.
- Steers—
effect of high-protein rations, Ill., 362.
feeding experiments, Ky., 253.
(See also Cattle.)
- Stegomyia. (See Aedes.)
- Stephanurus dentatus*—
life history, 774.
pre-parasitic stages in life cycle, 167.
studies, Fla., 374; P.R., 771.
- Stereochemistry, lectures on, 310.
- Stereum*—
neecator, studies, 850.
sanguinolentum, notes, 538; U.S.D.A., 239.
- Strictiphora cellularis*, synonymy, Va.Truck, 859.
- Strigmatocystis niger*, notes, 145.
- Sterility—
and abortion studies, Ky., 262.
in cattle, treatment, 562.
in domestic animals, 488.
in Indian crops, 622.
- Sterilizers, commercial, stability, in presence of milk, 466.
- Sterols, surface films, structure, 606.
- Stinkbug, southern green, injury by, Fla., 351.
- Stock. (See Livestock.)
- Stock foods. (See Feeding stuffs.)
- Stomach—
tissue, desiccated, for treatment of pernicious anemia, 398.
worms of sheep and goats, Tex., 666
- Stomata, number and distribution in citrus leaves, Calif., 734.
- Stomoxinae, classification and new species, 450.
- Stomoxys calcitrans*, surra transmission by, 487.
- Stomoxys nigra*, surra transmission by, 358.
- Stone for road building. (See Road materials.)
- Storage houses for fruits and vegetables, insulation, Pa., 81.
- Stovarsol specific for contagious agalaxia, 170.
- Straw—
artificial manure from, Mo., 17; N.Y. State, 21.
effect on soil productivity, Ill., 317.
- Strawberries—
breeding, 139.
cost of production, Ark., 885.
cost of production and marketing, Md., 387.
culture, Ohio, 527.
culture experiments, Alaska, 137.
descriptive notes, N.Y.State, 431.
fertilizer experiments, Ark., 335; Can., 836.
inflorescence types, 435.
insects affecting, West.Wash., 541.
mulching, value, Mich., 435.
new variety, N.Y.State, 431.
outlook for 1930, Okla., 784.
production and marketing, Md., 341.
root and shoot growth, 638.
spacing experiments, West.Wash., 524.
varieties, identification, 140.
variety tests, S.C., 636.
- Strawberry—
Blakemore, description, U.S.D.A., 140.
crown borer, biology and control, Mo., 54.
disease, Lanarkshire, factors affecting, 238.
diseases, studies, Fla., 345.
industry in United States, U.S.D.A., 179.
industry, Lanarkshire, problems, 238.
new or noteworthy variety, N.Y.State, 738.
runners, studies, Ohio, 41; U.S.D.A., 44.
- Streptococci, serologic specificity, 559.
- Streptococcus genitalium*, notes, Ky., 263.
- Streptothricosis in a bovine, pulmonary, 559.
- Streptothrix disease in kangaroos, 167.
- Strongyloides*—
avium n.sp. of chickens, 474.
stercoralis, studies, 560.
- Strongyloides parasitic in swine, 670.
- Strymon melinus*, life history, habits, and control, Tex., 246.
- Stymphylium* sp., notes, Fla., 344.
- Sudan grass and sorghum hybrids, 633.
- Sugar beet—
industry in Colorado and in United States, 178.
pulp, composition and nutritive value, 865.
pulp, dried v. mangels for dairy cows, 664.
- Sugar beets—
culture, Calif., 727.
rotation experiments under irrigation, U.S.D.A., 128.

- Sugar beets—Continued.
 studies, 513.
 variety tests, N.Dak., 129.
 yield and sugar in, relation to weather, 712.
 (See also Beets.)
- Sugar in blood. (See Blood sugar.)
- Sugar, maple. (See Maple.)
- Sugar production, crisis, papers on, 277.
 (See also Glucose.)
- Sugarcane—
 aphid, biological control, 646.
 aphids in Peru, 246.
 borer, control, 252, 544, 646.
 borer imported from Venezuela, parasite, 154.
 burned, harvesting experiments, 133.
 culture in Porto Rico, 32.
 experiments in Queensland, 522.
 fertilizer experiments, 129; Fla., 325; V.I., 219.
 froghopper, parasite for, 360.
 fuzz viability and December rainfall, 522.
 insects affecting, 245, 542, 643.
 mosaic resistant varieties, Miss., 146.
 mosaic, transmission, 153, 536.
 mycorrhizae, relation to root disease, 645.
 P.O.J. varieties, rate of deterioration of sugar in, U.S.D.A., 333.
 pokkah beng disease, symptoms, P.R., 747.
 root caterpillar, notes, 153.
 soils, management, P.R., 720.
 spacing experiment, V.I., 219.
 stilt bug, biology and control, 57.
 varieties, comparison, 129.
 variety tests, U.S.D.A., 333; V.I., 219.
 yellow stripe. (See Sugarcane mosaic.)
- Suits for the small boy, U.S.D.A., 298.
- Sulfates, action on Portland cement, 568.
- Sulfide sulfur content as basis for diluting lime-sulfur, Colo., 55.
- Sulfur—
 as limiting factor of crop production, 418.
 composting with different soils, Tex., 614.
 composting with manure, effect, Ga., 21.
 determination in organic compounds, 608, 609.
 dioxide, effect on vitamin C in fruits, 295.
 dust, effect on apple pollination, N.Y. Cornell, 840.
 fertilizing value, Ill., 316.
 fungicidal action, 532, 533.
 fungicides, effects on orchard trees, N.Y.State, 439.
 micro-determination by fusion, 608.
 mixtures. (See Lime-sulfur.)
 relation to cystine in animal hairs, 609.
- Sulfurous acid in apple musts and ciders, determination, 206.
- Sun baths and air, effect on metabolism, 290.
- Sunflower silage. (See Silage.)
- Sunflowers—
 at various growth stages, composition, 208.
 breeding, N.Y.Cornell, 731.
 insects affecting in Ukraine, 853.
- Sunlight—
 importance in forestry, 530.
 requirements of hens, N.Y.State, 68.
 through ultra-violet transmitting glass, clinical value, 593.
 (See also Light.)
- Sunshine—
 bright, effect on tomatoes under glass, 139.
 seasonal variation, effect in rickets prevention, N.Y.Cornell, 765.
- Suprarenal glands, effect of vitamin deficiency, 197.
- Surface films, structure, 606.
- Sulphosphat, comparison with other phosphates, 121.
- Surra—
 in Mauritius, vector of, 358.
 problem, zoological contributions, 454, 467.
 studies, 377.
- Swamp fever—
 in horses and mules, Tex., 606.
 virus, spontaneous infection of fowls with, 565.
- Swamp forests, reaction to drainage, 531.
- Swede dry-rot, cause and control, 148.
- Swedes, variety tests, N.Dak., 129.
- Sweet corn—
 breeding, P.R., 738.
 fertilizer experiments, Ill., 337; Ohio, 42.
 inbreeding, Ill., 337.
 protecting from corn ear worm, 248.
 seed, grading, effects, N.Y.State, 432.
 suckering, Can., 636.
 suckering, effect of heavy applications of manure, N.Y.Cornell, 737.
 varieties, N.Y.State, 431.
 varieties, early, Ohio, 42.
 yields, effect of number of plants per hill, 525.
 (See also Corn.)
- Sweet peas—
 history, development, and culture, 143.
 improvement, treatise, 843.
 purple-flowered rogue, Can., 638.
- Sweetclover—
 crosses, abnormal seed development in, 513.
 culture experiments, Ky., 218; N.Dak., 129; P.R., 731.
 effect on corn yield, Ill., 316.
 hard seeds, agricultural value, 133.
 moldy, poisonous to livestock, Ill., 374.
 seeds, identification, 136.

Sweetclover—Continued.

- soil-building power, nature of, Ill., 316.
- sowing in wheat, Ohio, 634.
- variety tests, Ill., 328; N.Dak., 129; Tex., 627.

Sweetpotato—

- black rot, control, Del., 746.
- industry in Delaware, Del., 783.
- sawfly, synonymy, Va.Truck, 859.
- storage houses, design and operation, Va.Truck, 883.
- vine cutter, Miss., 571.
- weevil in United States, status, 158.

Sweetpotatoes—

- culture, Md., 334.
- culture experiments, Miss., 31, 128; S.C., 625.
- fertilizer experiments, Ark., 828; Del., 728; Ga.Coastal Plain, 729; Md., 334; S.C., 625.
- inoculation with *Actinomyces* sp., results, Del., 746.
- production and handling, 226.
- seeding experiments, Ga.Coastal Plain, 729.
- shape, relation to potassium, 429.
- varieties, Miss., 31.
- variety tests, Ark., 828; Ga.Coastal Plain, 728.

Sweets for children, value, 584.

Swellhead of sheep and goats. Tex., 666.

Swine—

- fever in Great Britain, data, 260.
- hookworm, studies, P.R., 772.
- lungworms, development in intermediate hosts, 563.
- sanitation, importance, Ill., 375.
- (See also Pigs.)

Sycamore lace bug, notes, Del., 754.

Symptomatic anthrax. (See Blackleg.)

Tabanus rubidus—

- surra transmission experiments, 468.
- transmission of blackleg by, 168.

Tabanus spp., anthrax transmission experiments, 168.

Tangerines, notes, Fla., 335.

Tankage meat scrap, value for egg production, Mo., 67.

Tapeworms—

- in chickens, West.Wash., 558.
- in dogs, 265.

Tar distillate—

- wash, Long Ashton, field experiments, 448.
- washes and red spider, 252.

Tariff—

- data on oil and fats, 888.
- data on onions, 888.
- duties, papers on, 884.

Tarnished plant bug, effect on cotton plant, 655.

Taros. culture, P.R., 731.

Tax—

- laws for farmers and ranchmen, Colo., 283.
- laws, forest, summary, U.S.D.A., 342.

Tax—Continued.

- levies in Oregon, trends, Oreg., 483.
- system of Iowa, 885.

Taxation of forest lands, Ohio, 844.

Taxes on farm and urban real estate, Va., 573.

Taxonomy—

- forum on problems, 649.
- role of function in, 649.

Tea—

- fertilizer experiments, 529.
- fields, effect of urea, 842.
- green, vitamin C in, 295.
- insects affecting, 55.

Teeth—

- calcification on rachitic and nonrachitic diets, 693.
- caries, effect of mouth acidity, 491.
- decay in children, dietary control, 595.

Temperature—

- and moisture of air, effect of plant cover, 313.
- low, injury and death from, nature, Mo., 39.
- relation to poultry house design, Calif., 776.
- soil and air, daytime and nighttime, comparison, Calif., 505.
- variation with height above soil, 713.
- (See also Climate and Soil temperature.)

Tenthredinidae, oogenesis in, nucleolar phenomena, 548.

Teosinte tassels, malformation, 443.

Termites—

- communication among, 649.
- control in Gulf States, 245.
- effect on durability tests of wood, Calif., 742.
- habits and control, 154.
- in buildings, summary, U.S.D.A., 56.
- in Java, biology, 241.
- relation to building codes, 647.

Terraces, run-off from, data, 78.

Testis extracts, effect on castrated fowls and mammals, 624.

Tetany, fasting and phosphate, 694.

Tetrachlorethane, anthelmintic value, 877.

Tetrachlorethylene, anthelmintic value, 877.

Tetraethyl lead, effect on rate of combustion, 570.

Tetrameres americana, life history, 381.*Tetranychus*—

- pacificus*, notes, Calif., 752.
- telarius*. (See Red spider.)

Tetroda histioides, new pest of rice, 853.

Tettigidae, genetics, 321.

Texas fever in cattle, West.Wash., 558.

Texas Station, notes, 900.

Texas Station, report, 696.

Textiles—

- and clothing, Government publications, selected list, U.S.D.A., 795.
- popular information, Ill., 198.
- (See also Fabrics.)

- Thamnotettix* spp., life history notes, 853.
Thanatos flavidus attacking bedbugs, 246.
Thielavia basicola, notes, 145.
Thielaviopsis paradoxa, notes, 238.
 Thiourea for potato seed treatments, 224, 847.
 Thistle, Canada—
 characteristics and control, Colo., 37.
 eradication, relation to organic food reserves, Ohio, 136.
 Thrips injury to cotton, S.C., 650.
 Thrips—
 nigropilosus on cultivated spearmint, 241.
 tubaci. (See Onion thrips.)
Thrombicula autumnalis, adult form, 548.
 Thumb, hereditary growth anomaly, 216.
 Thyroid glands of sheep, iodine in, seasonal variation, 254.
 Thyroids—
 size in races of pigeons, 216.
 size, inheritance, 823.
 Thysanoptera—
 injury from, 541.
 on cotton, biology, 155.
 Tick fever. (See Texas fever.)
 Ticks—
 and other animal pests of medical importance, treatise, 542.
 nymphal, resistance to arsenical dips, 263.
 (See also Cattle ticks.)
Tilletia—
 horrida, notes, Ark., 845.
 tritici. (See host plants.)
 Timber growing and cutting in lodgepole pine region, U.S.D.A., 45.
 (See also Wood.)
 Time, use by farm homemakers, Oreg., 496.
 Timothy—
 and alsike clover mixtures, analyzing and labeling, 136.
 breeding, N.Y.Cornell, 731.
 hay v. Johnson grass hay for horses and mules, Ala., 704.
 hays of Quebec, calcium and phosphorus in, 549.
 production tests, Alaska, 127.
 Tin weighting of silk fabrics, effect, 793.
Tirathaba rufivena, new parasites, 360.
Tmetocera ocellana. (See Bud moth, eye-spotted.)
 Toads, giant, value, P.R., 751.
 Tobacco—
 Alternaria leaf spot, studies, Fla., 345.
 and weather, 611.
 angular leaf spot, notes, Ky., 234.
 animal enemies, 355.
 beetle control in upholstered furniture, 241.
 black root rot, effect of soil reaction and temperature, 444.
 black root rot resistant strains, Conn. State, 833; Ky., 234.
 black shank, studies, Fla., 345.
 Tobacco—Continued.
 brown root rot, studies, Conn.State, 833.
 brown rot, notes, Ky., 234.
 chemical studies, Conn.State, 833.
 cigar, production in Pennsylvania, U.S.D.A., 134.
 cigarette, production, 226.
 cigar-filler, effect of fertilizers, Pa., 334.
 diseases, notes, Fla., 345.
 experiments, Conn.State, 831; Pa., 37.
 fertilizer experiments, Conn.State, 832; Fla., 325; Ga.Coastal Plain 730; Ind., 30; S.C., 625.
 fire-holding capacity, differences, Conn. State, 832.
 flowers, bagging, efficiency of materials for, 134.
 frog-eye leaf spot, studies, Fla., 345.
 grades, chlorine in, Ky., 218.
 Growers' Cooperative Association, business analysis, U.S.D.A., 285.
 high-nicotine, production trial, Tex., 627.
 interchanges between plant and culture solution, 319.
 magnesium and calcium requirements, 721.
 manganese toxicity, 620.
 mosaic infection from tobacco users, Ky., 233.
 mosaic transmission by aphids, 854.
 mosaic virus, overwintering, Wis., 350.
 plants, glass-protected, effect on wildfire, Pa., 347.
 poor burning v. good burning, composition, Conn.State, 832.
 raising by tractor, Conn.State, 834.
 rotation, crops for, Ga.Coastal Plain, 731.
 seed beds, insects in, control, 55.
 seedlings, damping-off, Conn.State, 834.
 spacing tests, Ga.Coastal Plain, 730.
 thrips on narcissus, Fla., 352.
 variety tests, Ga.Coastal Plain, 728.
 wildfire, studies, Fla., 345; Ky., 234.
Tomaspiis saccharina, parasite for, 360.
 Tomato—
 bacterial canker, notes, West.Wash., 532.
 bud sport, few-seeded, 513.
 diseases, studies, Fla., 344.
 late blight, notes, 145, 148.
 leaf spot, control, 148.
 mosaic, studies, Ky., 233.
 plants, analysis, 432.
 plants, effect of phosphorus deficiency, 837.
 plants, growth in various containers, S.C., 636.
 plants, southern-grown, handling, Del., 745.
 products, spoilage, studies, N.Y.State, 9, 10.

Tomato—Continued.

- seed, disinfection, Del., 746.
- tissues, green, nitrate in, 432.
- wilt organism, studies, Mo., 50.
- yellows resistance, studies, Calif., 723.

Tomatoes—

- breeding, Miss., 38, 137; N.Y.State, 431.
 - cannery, variety tests, Md., 838.
 - chromosome mutant forms, Calif., 723.
 - composition, Calif., 737.
 - cultural data, Ohio, 41.
 - culture experiments, P.R., 737; V.I., 227.
 - early-ripening varieties, West.Wash., 523.
 - effect of mulching paper, N.Y.Cornell, 737.
 - effect of pruning and staking, Mont., 227.
 - effect of removing apical bud. Pa., 338.
 - fertilizer experiments, Ark., 835; Fla., 334; Miss., 39, 138; N.Y.State, 431; Ohio, 41.
 - greenhouse-grown, effect of sunshine, 139.
 - plant selection work, Ill., 337.
 - prices, relation to quality, 576.
 - pruning and staking, value, N.Y.Cornell, 737.
 - respiration, studies, 837.
 - ripening, development of vitamin A during, 93.
 - shipping tests, Miss., 138.
 - spacing experiments, Tex., 637.
 - staking and pruning, Ark., 835; Can., 836.
 - strain tests, Ill., 337.
 - varieties, N.Y.State, 431; Pa., 339.
 - variety tests, Miss., 39, 138; N.Dak., 138; Tex., 636, 637; U.S.D.A., 40.
 - wilt-resistant, tests, Mo., 39; Va. Truck, 849.
- Tomato-potato chimera, studies, 28.
- Tomostethus fuscicornis*, studies, 159, 859.
- Tortricids in Nova Scotia, habits and life histories, 454.
- Tortrix polittana* on pine seedlings, 450.
- Toucan life history in Canal Zone, 240.
- Towns, small, trade and culture, 582.
- Toscaoris canis*, moisture requirements of eggs, 240.
- Tosoptera graminum*, injury caused by, 544.
- Tracheitis, infectious, 172.
- Tractor yarding in forest areas, costs, Calif., 46.
- Tractors—
- and motor vehicles, treatise, 673.
 - horses and farm equipment, Iowa, 83.
 - on New York farms, N.Y.Cornell, 781.
 - reduce horse feed, Ohio, 677.
 - testing by Agricultural Academy of Berlin, 673.
- Trade, foreign, of United States, U.S.D.A., 573, 579, 889.
- Tree seeds, improved forest, 438.
- Tree wound dressings, 228.
- Treehoppers, ants associated with, 861.
- Trees—
- coniferous. (See Conifers.)
 - evergreen, chlorophyll in, periodical variations, 24.
 - for farmers and ranchmen, Wyo., 532.
 - forest, tolerance, Vt., 232.
 - growth, vertical, 820.
 - hardwood, girdling to release spruce and balsam fir, 844.
 - hardwood, growth relation to thinning, 844.
 - hardwood, yield tables, 532; Mich., 438.
 - improper pruning in, Ill., 335.
 - of Alaska. pocket guide, U.S.D.A., 743.
 - seedling, hardening process, 641.
 - seedling, size, relation to vigor, Ohio, 343.
 - shade, tests, N.Dak., 138.
 - small, wasteful cutting, U.S.D.A., 844.
 - transplanting, U.S.D.A., 144.
- Trembles. (See Milk sickness.)
- Triaspis curculionis*, parasite of boll weevil, U.S.D.A., 359.
- Tribolium navale* in stored rice, 542.
- Trichinosis in pigs, skin reactions in, 563.
- Trichlorethylene, anthelmintic value, 877.
- Trichogramma evanescens*, notes, 545.
- Trichogramma minutum*—
- control of sugarcane borer by, 252.
 - mass production, 647.
 - notes, Del., 754; N.Y.State, 449; S.C., 651.
 - successful shipments, 241.
 - sulfur a repellent to, 653.
 - usefulness, 650.
- Trichopoda pennipes*, notes, Fla., 351.
- Trichosporium tingens* n.sp., notes, 538.
- Trichuris depressiusculus*, notes, 266.
- Triethanolamine oleate for oil sprays, 543.
- Trionycha of Porto Rico, 548.
- Trioxa viridula*, biology and distribution in Sweden, 355.
- Triplets in relatively homozygous family, 625.
- Triticum hybrids, chromosome behavior in, 621.
- Tropisms, studies, 539.
- Truck crops—
- fertilizer experiments, Ill., 337.
 - insects affecting, 653.
 - tests, Tex., 637.
- Trucks. (See Motor trucks.)
- Trypanosomiasis in camels, mercuric chloride test for, 77, 263.
- Tryptophane—
- and growth, 191.
 - deficient diet. indole derivatives as substitute, 790.
- Tubercle bacilli—
- bovine, culturing, 560.
 - bovine, infection in man, 560.
 - types, 560.

Tuberculin—

- avian, v. Johnin, as diagnostic agent for John's disease, 260.
- test, intravenous, value, 500.
- test reacting cattle, absence of lesions, N.Y.State, 469.
- test, reliability, U.S.D.A., 377.
- testing methods, 76.

Tuberculosis—

- avian, in Nebraska, 474.
- avian, studies, 269; Ill., 379.
- B. C. G., vaccination against, 169, 470; Calif., 770.
- bovine, in man, prevention, 561.
- eradication, economic benefits, U.S.D.A., 773.
- eradication work, 555.
- filtrable virus, 76.
- in a cowbird, 377.
- in cattle, 377, 875.
- research problems, 772.
- vaccination against, 875.

Tularemia—

- contracted from a coyote, 576.
- from opossums, 561.
- in North America and Russia, 378.
- transmission to sheep by wood tick, 264.
- treatise, 263.

Tulips—

- culture experiments, S.C., 636.
- treatise, 143.

Tumors—

- in man, Mendelian behavior, 514.
- in tooth carp hybrids, 824.

Tung oil—

- experiments, Fla., 335.
- tree, culture experiments, Tex., 636.

Turkeys—

- cost of growing and managing, 552.
- Elmeria species in, 267.
- in Montana, 164.
- raising in Wisconsin, 554.

Turnip—

- aphid, control, Tex., 652.
- dry-rot, cause and control, 148.
- root louse, control, Tex., 652.

Turnips, culture experiments, P.R., 737.

Turpentine and linseed oil, anthelmintic value, 877.

Twig girdler, studies, Miss., 53, 152.

Twin production in rodents, 517.

Twinning, diagnosis of type, 422.

Twins—

- and double monsters, amount of external mirror imagery, 824.
- identical, mental and physical traits, 517.

Tylenchus—

- contortus laticis* n.sp., description, 547.
- contortus typographi*, description, 547.
- dispar*, notes, 145; West.Wash., 59.
- dispar cinerei* n.sp., description, 547.

Tylosderma fragariae. (See Strawberry crown borer.)*Typha jacobaeae* for control of ragwort, 247.

Uba cane as forage crop, P.R., 731.

Ultra-violet—

- component of sunlight of Portland, Oregon, 592.
- irradiation and mutations, 512.
- irradiation of school children, 593.
- light, effect on *Bacillus radicola*, Mo., 17.
- Light, ossifying power, 396.
- radiation, measuring, zinc sulfide method, 592.
- radiation, sources and characteristics, 592.
- solar radiation, data, 479.

Undernutrition. (See Diet deficiency and Nutrition.)

Undulant fever—

- and epizootic abortion, relation, 262, 875.
- experimental infection, 668.
- in man and abortion in cattle, Mich., 668.
- public health aspects, 876.
- studies, 169, 260, 262.
- summary, 468.
- treatment by protein extract from *Bruceella abortus*, 169.
- treatment with acriflavine, 468.
- with clinical syndrome of intermittent hydrarthrosis, 169.

United States Department of Agriculture—

Bureau of Agricultural Economics. (See Bureau of Agricultural Economics.)

Bureau of Entomology. (See Bureau of Entomology.)

Bureau of Plant Industry. (See Bureau of Plant Industry.)

organization list and Department functions, U.S.D.A., 390.

publications available, U.S.D.A., 497.

Weather Bureau. (See Weather Bureau.)

Urea—

- as source of nitrogen for tomatoes, Miss., 138.
- for old tea fields, 842.

Uredinales, treatise, 47.

Urine—

- of cattle, hippuric acid elimination in, 264.
- of foot-and-mouth disease affected animals, infectivity, 168.
- of ovariectomized monkeys injected with ovarian hormone, recovery, 325.

Urosalpinx armatus, notes, U.S.D.A., 251.*Ustilago* spp., physiologic specialization in, 643.*Ustilina zonata* in rubber plantations, 289.

Utah College, notes, 799.

Utah Station, notes, 799.

- Uterine—
bleeding as sign of pregnancy, 726.
reaction, special, produced by corpus luteum extracts, 126.
- Utero-chorionic lesions in cows, significance, 264.
- Vacuum—
cleaner, energy cost of operating, 198.
fumigation, notes, 448.
- Vaginal—
curettage for diagnosing pregnancy in guinea pigs, 324.
smears, ineffectiveness in predicting oestrus, 625.
- Vanilla extracts, bean content, estimating, 808.
- Vanillin determination, Mojonnier milk tester for, 808.
- Vas deferens ligature, effects in small animals, 29.
- Vascular bundles in corn, course and branching, 123.
- Vegetable—
gardening. (*See Gardening.*)
prices, relation to quality, 376.
proteins. (*See Proteins.*)
storages, insulation, Pa., 81.
tissues, iron in, Miss., 111.
weevil, control, Calif., 752.
- Vegetables—
buying, preferences and practices, R.I., 485.
car-lot shipments, U.S.D.A., 887.
culture, Can., 637; Ga.Coastal Plain, 738.
culture experiments, 138; Alaska, 137; N.Dak., 138.
culture in Porto Rico, 42.
distribution by wholesalers and jobbers, N.Y. Cornell, 680.
fertilizer experiments, Ill., 337.
freezing storage experiments, Calif., 787.
insects affecting. (*See Garden insects.*)
iodine in, 808.
nonacid, canning, Fla., 392.
oriental, composition and use, Hawaii, 685.
outlook for 1930, Okla., 784.
Philippine, composition, 686.
production, textbook, 836.
storage, Okla., 288.
storage and transport temperatures, optimum, 139.
studies, Can., 524.
sundrying, Okla., 288.
varieties, select list, Tenn., 738.
variety tests, Alaska, 137; Miss., 38, 137.
vitamins in, 395.
- Vegetarian diet—
growth and reproduction of rats on, 91.
metabolism of rats on, 91.
- Velvetbeans—
uses, P.R., 731.
variety tests, Ga.Coastal Plain, 728.
- Venturia pyrina*, notes, 149.
- Vermont—
Commission on Country Life, 885.
Station, report, 399.
- Vetch—
as cover crop in pecan orchards, Fla., 335.
hairy, as cover crop, S.C., 33.
seeding experiments, Ga.Coastal Plain, 729; West.Wash., 518.
seeds, hard, germination, 135.
variety tests, Ga.Coastal Plain, 728; Tex., 627.
- Veterinary—
adviser, treatise, 260.
Research, Government Institute for, at Chosen, 260.
research report, 467, 558.
(*See also Animal diseases.*)
- Vigna hoeset*, insect pests, 450.
- Village service agencies of New York, N.Y. Cornell, 683.
- Vinegar flies, carriers of yeast and bacteria to fruits, Calif., 744.
- Vineyard insects, control, 540.
- Violet midge in southern Italy, 154.
- Vlosterol, use of term, 590.
- Virgin Islands Station, report, 299.
- Virginia—
College, notes, 600.
Station, notes, 600, 799.
statistical study, 582.
- Virus, filtrable, and Rickettsia diseases, 169, 467.
- Viscosimeter—
torsion pendulum, viscosity determined by, 871.
value in commercial flour mill laboratory, 710.
- Vitaglass, clinical value of sunlight through, 593.
- Vitality, relation to underweight and overweight, 290.
- Vitamin A—
absorption spectrum, 113.
acceleration of lipase activity by, 587.
and carotin, 587.
antimony trichloride test for, 207, 208.
as anti-infective agent, 294.
assay, 208.
assays of fish oil, comparison, 111.
assimilation in presence of mineral oil, Pa., 397.
deficiency, effect on hematopoietic function, 297.
deficient rats, bacteria in nasal cavities and middle ear, 493.
development during ripening of tomatoes, 93.
distribution in foods, U.S.D.A., 293.
in animal nutrition, Fla., 897.
in avocados, 193.
in butter and other fatty foods, 111.

Vitamin A—Continued.

- in cod-liver oil, antimony trichloride test, 112.
- in corn-milling products, distribution, 492.
- in crude and refined olive oil, 791.
- in eggs of hens receiving cod-liver oil, N.Y.Cornell, 788.
- in foods, Tex., 692.
- in green leaves, nature, 206.
- in Helioctin, 396.
- in human fetuses, 692.
- in lettuce leaves, green and white, 397.
- in lettuce, relation to soil fertility, 193.
- in oats, Ill., 391.
- in spinach leaves, relation to size, 791.
- in vitaminized margarine, 895.
- in yellow corn, Ill., 391.
- relation to carotin, 492.
- technic, effect of potency of yeast, Pa., 397.

Vitamin A-tauerocholic acid, preparation, 93.

Vitamin, antineuritic—

- of brewers' yeast, activity and nitrogen in, 711.
- of milk, effect of heat, 294.

Vitamin B—

- a second thermolabile factor from, 589.
- and G in yeast, differentiating, 113.
- antipellagric factor of, 97.
- complex, review and discussion, 493.
- composite nature, 587.
- deficiency and learning ability, 897.
- deficiency, effect on carbohydrate metabolism, 896.
- deficiency, effect on hematopoietic function, 297.
- deficiency, effect on rats, 587.
- deficiency in nursing young, production, 494.
- determination, technic, 897.
- distribution in foods, U.S.D.A., 293.
- factors in autoclaved yeast, effect of pH control, 113.
- for lactation, milk as source, 896.
- formation, detection, 94.
- fractional precipitation, 711.
- in cereals, Ill., 390.
- in infant feeding, importance, 692.
- in ripe and germinating wheat, 792.
- in spinach, effect of method of preparation, Mo., 94.
- in string beans, effect of method of preparation, Mo., 94.
- isolation method, 607.
- nomenclature, 94.
- requirements in infancy, 397.
- values of foods, comparative, 294.

Vitamin B₁. (See Vitamin E.)Vitamin B₂. (See Vitamin G.)

Vitamin balance and hypervitaminosis, 196.

Vitamin C—

- assay, improvement, 607.
- concentrates from lemon juice, preparation and properties, 501.

Vitamin C—Continued.

- deficient diet for scurvy study, 198, 588.
- detection, 113.
- distribution in foods, U.S.D.A., 293.
- in apples, Mo., 95.
- in cucumbers, fresh and pickled, 398.
- in ensiled grass, 163.
- in fresh sauerkraut, 538.
- in green tea, 295.
- in kale and mustard greens, Ky., 294.
- in lemon juice, preparation and properties, 804.
- in lemon juice, stability, 803.
- in rhubarb, Mo., 95.
- in spinach, Mo., 95.
- role in nutrition of calves, 554.

Vitamin D—

- absorption spectrum, 114.
- and fecal reaction, 296.
- assay, effect of changes in weight of test rats, 197.
- chemical reaction for, 114.
- determination, methods, 897.
- different intakes, responses to, 494.
- effect of overdosage, 792.
- effect on eggshell thickness, Ky., 256.
- from sterols of mummified Egyptian brain, 538.
- in burbot-liver oil, 95.
- in cod-liver oil, stability, effect of storage in mash mixture, N.Y.Cornell, 759.
- in eggs of hens receiving cod-liver oil, N.Y.Cornell, 788.
- in ergot of rye, 588.
- in Helioctin, 396.
- in ice cream, 95.
- in irradiated ergosterol poisoning, specificity, 196.
- in kale and mustard greens, Ky., 293.
- in milk, 495.
- in milk, effect of irradiated yeast feeding, 495.
- in vitaminized margarine, 895.
- irradiated milk v. cod-liver oil as source, 692.
- preparations, evaluation, 296.
- problem, 502, 804.
- production, 606.
- stability, effect of heat and exposure to air, 662.
- synthesis, 590.

Vitamin deficiency, effect on suprarenal gland in rats, 197.

(See also Avitaminosis.)

Vitamin E—

- action on ovarian function, 899.
- deficiency, effect on hematopoietic function, 297.
- requirements of poultry, 552.

Vitamin F—

- assay, 195.
- in autoclaved yeast, effect of pH control, 113.
- in cereals, Ill., 390.

Vitamin F—Continued.

- relation to renal enlargement in rats on high protein diets, 493.
- requirements of albino mice, 894.
- sparing action of fat on, 293.

Vitamin G—

- and B in yeast, differentiating, 113.
- in autoclaved yeast, effect of pH control, 113.
- in cereals, Ill., 390.
- in certain foods, distribution, 194.
- relation to renal enlargement in rats on high protein diets, 493.
- requirements of albino mice, 894.

Vitamin requirements of growing fetus, 692.**Vitamin research, recent advances in, 587.****Vitaminismus, use of term, 96.****Vitamins—**

- effect of anemia of rice disease, 596.
- in canned foods, 93, 396.
- in food materials, U.S.D.A., 293.
- in German food materials, 395.
- in honey and honeycomb, 93.
- in pears, effect of canning methods, 396.
- in pineapple bran, Hawaii Pineapple Cannery, 457.

Vocational education—

- Federal Board for, report, 89, 685.
- in home economics under George-Reed Act, 89.
- objectives and problems, symposium, 186.
- (See also Agricultural education, vocational.)

Volcanic soils of Sakurajima, Japan, microbiological studies, 118.**Vulvovaginitis in hogs, Ill., 375.****Walking disease among horses and cattle, summary, 877.****Walls, retaining, stability, U.S.D.A., 567.****Walnut—**

- caterpillar, life history studies, Miss., 53, 152.
- chlorosis, treatment, Calif., 745.
- crown rot organism, inoculation tests, Calif., 744.
- husk fly, Calif., 751.
- husk fly, life history and control, 455.
- oil, California, composition, 109.
- sapwood, age, 641.
- supply and price situation, Calif., 179.
- trees, growth studies, Pa., 342.
- trees, spraying, Calif., 745.
- trees, tank experiments, Calif., 744.
- yellow or rosette, notes, Calif., 744.

Warble fly. (See Ox warble flies.)**Warts in cattle, etiology, 470.****Washington College, notes, 700.****Washington Station, notes, 700.****Waage—**

- of family Sphegidae, monograph, 861.
- paper, as pests in bird houses, 547.
- parasitic, effect of X-rays, 214, 457.
- silicid wood, in Great Britain, 359.

Water—

- added to milk, detection, 312.
- buffaloes, determination of age, 658.
- flow in riveted steel and analogous pipes, U.S.D.A., 778.
- grass, control, Calif., 777.
- irrigation. (See Irrigation water.)
- level investigation, 567.
- losses, run-off, relation to crop production, Tex., 614.
- purification methods for dairies, 884.
- resources of North Dakota, 672.
- supply of south Atlantic slope and eastern Gulf of Mexico drainage basins, 672.
- supply of United States, 271, 779.
- supply systems, farm, for Wisconsin conditions, 275.
- systems, farm, installation, 572.
- utilization of plants, 820.

Watering system, automatic, for plant growth studies, 820.**Watermelons, fruit thinning studies, Ga. Coastal Plain, 736.****Water-soluble B. (See Vitamin B.)****Water-soluble C. (See Vitamin C.)****Wax moth—**

- caterpillars, antitoxic immunity, 454.
- metamorphosis, 556.

Weather—

- and climate, relation to insects, 850.
- and cotton yields in Texas, correlation, U.S.D.A., 809.
- and crops, relation, 611.
- Bureau, frost warning service in San Joaquin Valley, U.S.D.A., 504.
- Bureau, report, U.S.D.A., 610.
- conditions, effect on forest fires, Wis., 15.
- effect on corn yields, Mo., 31.
- types, relation to plant growth, 114.
- (See also Meteorological observations and Meteorology.)

Weatherstripping of residence windows, 572.**Weeds—**

- biological control, 646.
- control, U.S.D.A., 331.
- control by tillage, N.Y. Cornell, 737.
- control by zinc sulfate, U.S.D.A., 743.
- distribution, relation to soil type in Saskatchewan, 186.
- effect on combine operation, Minn., 478.
- eradication by chemicals, 227.
- eradication from pasture lands, 131.
- in cereals, control by harrowing, 227.
- of New Jersey, N.J., 523.
- perennial, in irrigated areas, Mont., 219.
- spraying with chlorates, Ohio, 634.
- Weedy lands, cleaning up, demonstration, N.Dak., 129.
- West Virginia Station, notes, 400.
- Western Washington Station, report, 599.

Wheat—

- and wheat products, foreign trade in, U.S.D.A., 889.
- and wheat products, heat treatments, 708.
- Australian, unsound economics of F. A. Q. Standard for selling, 889.
- black chaff disease, relation to physical and pathological characters, 644.
- black stem rust resistant, segregate, 440.
- bread-making quality, determination, 130.
- breeding, Mo., 31; N.Y.Cornell, 731; Tex., 627.
- bunt. (*See* Wheat smut, stinking.)
- combined, market discounts for, S.Dak., 780.
- cost of production, Mo., 82.
- crosses, correlated inheritance in, 27.
- Day, program, Ohio, 90.
- diseases, experiments and discoveries, 146.
- drying, 429.
- effect of delayed harvesting, 523.
- effect of fallow on yield and protein in, Mont., 226.
- export debenture plan for, 285.
- fertilizer experiments, 130; Ark., 828; Ky., 218; S.C., 625; U.S.D.A., 32.
- flour. (*See* Flour.)
- foot rot, notes, Mont., 234.
- frosted, field tests, Mont., 219.
- germination and growth, effects of seed treatment, 634.
- goat grass as pest, 137.
- growth, relation of leaf acidity, 24.
- harvesting at different stages of maturity, 518.
- harvesting with combine, Minn., 478.
- high-quality production, Ohio, 37.
- hybrids, bulked population experiment, 124.
- improvement, Mont., 219.
- kernels, distribution of vitamin G in, 194.
- loose smut infection, factors affecting, 48.
- milling and baking tests, 430.
- outlook charts, U.S.D.A., 387.
- outlook for 1930, Okla., 734.
- plant, changes in buffer system during growth, 617.
- Pool, Canadian, 276.
- preparing summer fallow for, Mont., 219.
- prices and grain storage situation, U.S.D.A., 577.
- prices, post-harvest depression, 888.
- prices, variations, 181.
- production in Kansas, Kans., 634.
- protein content, effect of fertilizers, 211.
- ripening and germinating, vitamin B in, 792.
- rod-row trials, N.Dak., 129.

Wheat—Continued.

- root rot, notes, 535.
- rotation experiment, Ill., 315.
- rust, effect of mixed cropping, U.S.D.A., 331.
- rust resistant variety, 699.
- rusts, appearance and incidence, 147.
- rusts, effect on yield, 147.
- (*See also* Wheat stem rust.)
- scab, control, U.S.D.A., 236.
- sclerotal disease, notes, 535.
- seeding experiments, Ga.Coastal Plain, 728.
- situation, August to November, 1929, 888.
- situation, December, 1928, to April, 1929, 181.
- situation, world, 888.
- situation, world, as basis for marketing program, 89.
- smut in Montana, 535.
- smut resistant varieties, Mont., 234.
- smut, stinking, breeding for resistance, 147.
- smut, stinking, prevention, 147, 533.
- smut, stinking, resistance, Calif., 441, 745.
- smut, stinking, resistance, inheritance, 846.
- smut, stinking, varietal resistance, N. Dak., 349.
- smuts, notes, 535.
- smutty, washing, U.S.D.A., 134.
- spring, resistance to lodging, Ill., 327.
- spring, variety tests, Ill., 327; N.Dak., 129.
- stem rust resistance, relation to stomatal behavior, 535.
- (*See also* Wheat rust, Rusts, and Barberry eradication.)
- stem sawfly, value of trap crops, 541.
- sterility in, factors affecting, Del., 728.
- susceptibility to fusarial head blight, Minn., 236.
- varieties, Ga.Coastal Plain, 728.
- varieties, baking qualities, Ill., 390.
- varieties, improved, registration, 523.
- variety date-of-seeding experiment, 220.
- variety tests, Alaska, 127; Ark., 828; Calif., 727; Del., 728; Mo., 31; N.C., 37; S.C., 625; Tex., 626.
- weak and strong, digestibility for poultry, 868.
- winter hard red, breeding, U.S.D.A., 134.
- winter hard red, varieties, U.S.D.A., 37.
- winter hardiness, Ill., 327.
- winter, physical measurements at various stages, 522.
- winter, seeding experiments, Mont., 219.
- winter, varieties, 130.
- winter, variety tests, Ill., 327; Ind., 30.

- Wheat—Continued.
 yellow rust resistant strains, 147.
 yield and composition, effect of different nutrients, 121.
 yield relation to weather, 811.
- Wheat-rye hybrid, prophase of heterotypic division in, 511.
- Whey as pasture supplement for pigs, 163.
- White ants. (*See* Termites.)
- White fly, citrus—
 campaign in California, 448, 449.
 parasite of, 360.
- White pine—
 blister rust and pifion rust, differentiation, 750.
 blister rust, eradication work, 150.
 slash decay in southern New England, U.S.D.A., 239.
 weevil, natural history, 648.
- Wild life reservations, national, U.S.D.A., 52.
- Willow weevil, control, Calif., 752.
- Willows, basket, culture, 144.
- Wind, effect on spread of mosquitoes, 249.
- Window materials, solarization, 479.
- Windows, weatherstripping for, 572.
- Winds, desiccating, effect on citrus trees, Calif., 722.
- Winthemia quadripustulata*, notes, U.S.D.A. 251.
- Wireworms—
 biological studies, 450.
 methods of study, 647.
 natural enemies and control, Pa., 354.
 parasites of, 456.
- Wisconsin—
 Station, notes, 100.
 University, notes, 100.
- Women—
 in agriculture, contribution, 278.
 rural, education, 278.
- Wood—
 compression in redwood, Calif., 742.
 maturation in grapevines, 123.
 post, preservative treatment, value of copper compounds, Ark., 879.
 pulp. (*See* Pulpwood.)
 small dimension stock, seasoning, handling, and manufacture, 672.
 tick, transmission of tularemia by, 264.
 treatise, 843.
 unseasoned, protection from injurious insects, U.S.D.A., 55.
 (*See also* Timber.)
- Woodpecker, California, food habits, 539.
- Woody cuttings, rooting, 838.
- Wool—
 fat, composition, 112.
 home-grown, marketing in England, 182.
 production, papers on, 276.
- Woolly aphid. (*See* Aphid, woolly.)
- Xanthates, oxidation, 805.
- Xanthogen disulfides and monosulfides, new, 805.
- Xanthophyll in green leaves, extraction and separation, 616.
- X-rays—
 and somatic mutations, 214.
 changes in gene alignment produced by, 621.
 effect on chromosome translocations, 214.
 effect on mutations in oats and wheat, 510.
 effect on Nicotiana, 215.
 effect on parasitic wasps, 214, 457.
 effect on plant neoplasms, 122.
 effect on somatic mutations, 724.
 effect on spermatogenesis, 516.
 mutations produced by, 322.
 relation to chromosome translocations in *Drosophila*, 124.
- Xylomyces I, notes, 538.
- Xylose, fermentation by nodule bacteria, 414.
- Yautias, culture, P.R., 731.
- Yeast—
 and mold counts in butter, relation to keeping quality, 464.
 extract, a second thermolabile factor from, 589.
 in bottled beverages, heat destruction, Calif., 787.
 nitrogen in, determination, 312.
 potency, effect on vitamin A technic, Pa., 897.
- Yellow aphid, notes, 153.
- Yellow fever—
 in South America, studies, 856.
 mosquito, notes, 454.
 transmission by mosquito excreta, 249.
 virus, hereditary transmission by mosquitoes, 857.
 virus in the mosquito, filtrability, 857.
 virus, transmission, 249.
- Zatropa incertus*, parasite of boll weevil, U.S.D.A., 359.
- Zeuzera pyrina*. (*See* Leopard moth.)
- Zinc—
 ammonium phosphate precipitation, effect of pH, 608.
 effect on plants and animals, Ky., 203.
 essential nature for plant growth, 619.
 in normal nutrition, 585.
 sulfate for weed control, U.S.D.A., 743.
 sulfide method of measuring ultra-violet radiation, 592.
- Zoogeography of Java, 539.
- Zoology—
 agricultural, of Malay Archipelago, 538.
 applied, and fur farming, 241.
 experimental, textbook, 213.
 textbook, 538.
- Zoomastigina, revision, 671.

